APRIL 1959—SIXTY-FIFTH YEAR

# Machinery

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# Machinery

**APRIL 1959** **VOL. 65 No. 8**

***THE MONTHLY MAGAZINE OF ENGINEERING AND PRODUCTION IN THE MANUFACTURE OF METAL PRODUCTS***

SHOP PRACTICE



MACHINE AND TOOL DESIGN



MANAGEMENT PROBLEMS

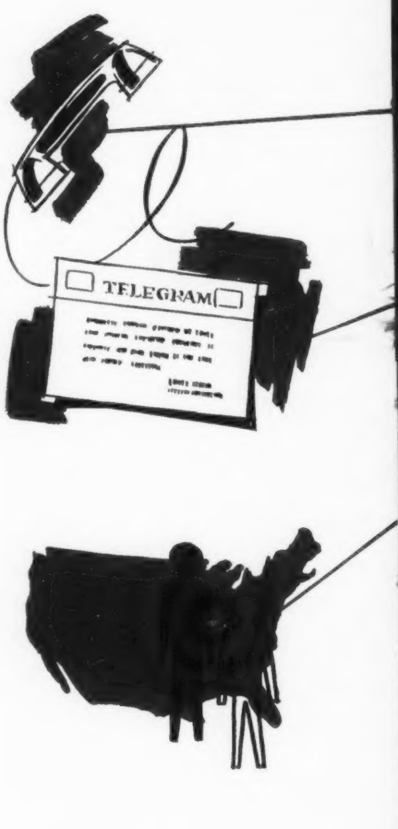


REFERENCE SECTION



DEPARTMENTS

# *There is a Threading Specialist* IN YOUR SHOP



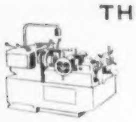

He is your Landis Service Representative. Although not in your plant every minute of every day, a phone call or wire will bring him to you promptly. Down time, improper chaser life, failure to meet specifications . . . these are the types of problems your Landis Service Man helps you to avoid.

These Service Representatives, located throughout the country, can help you in many ways. For example, they can show you how to best use your threading equipment (whether the operation is by cutting, grinding, tapping, or rolling) to save you time and money. They will aid in translating the general sales literature data into specific information on producing your particular threading job. They can describe the special equipment that has been designed for threading unusual and difficult-to-handle workpieces. By working with our Engineering Department, they are able to provide additional information on similar equipment for your special threading requirements. These are but a few of the many ways the Landis Service Representative can help you.

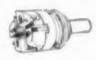
All LANDIS Equipment is guaranteed to produce threads to meet the degree of accuracy and production for which it is sold. Our extensive staff of Service Men, plus the above guarantee, emphasize the value LANDIS assigns to satisfied customers. We sell performance, not just products, and you become an expert on threading, when our experienced Service Representatives are at your service.

**LANDIS *Machine* COMPANY** WAYNESBORO • PENNSYLVANIA

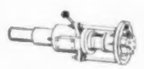
THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT



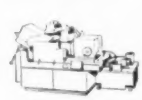
Threading Machines



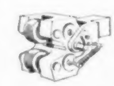
Die Heads—Rotary & Stationary



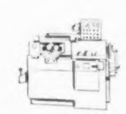
Taps—Collapsible & Solid Adjustable



Centerless Thread Grinding Machines



Thread Rolling Tools

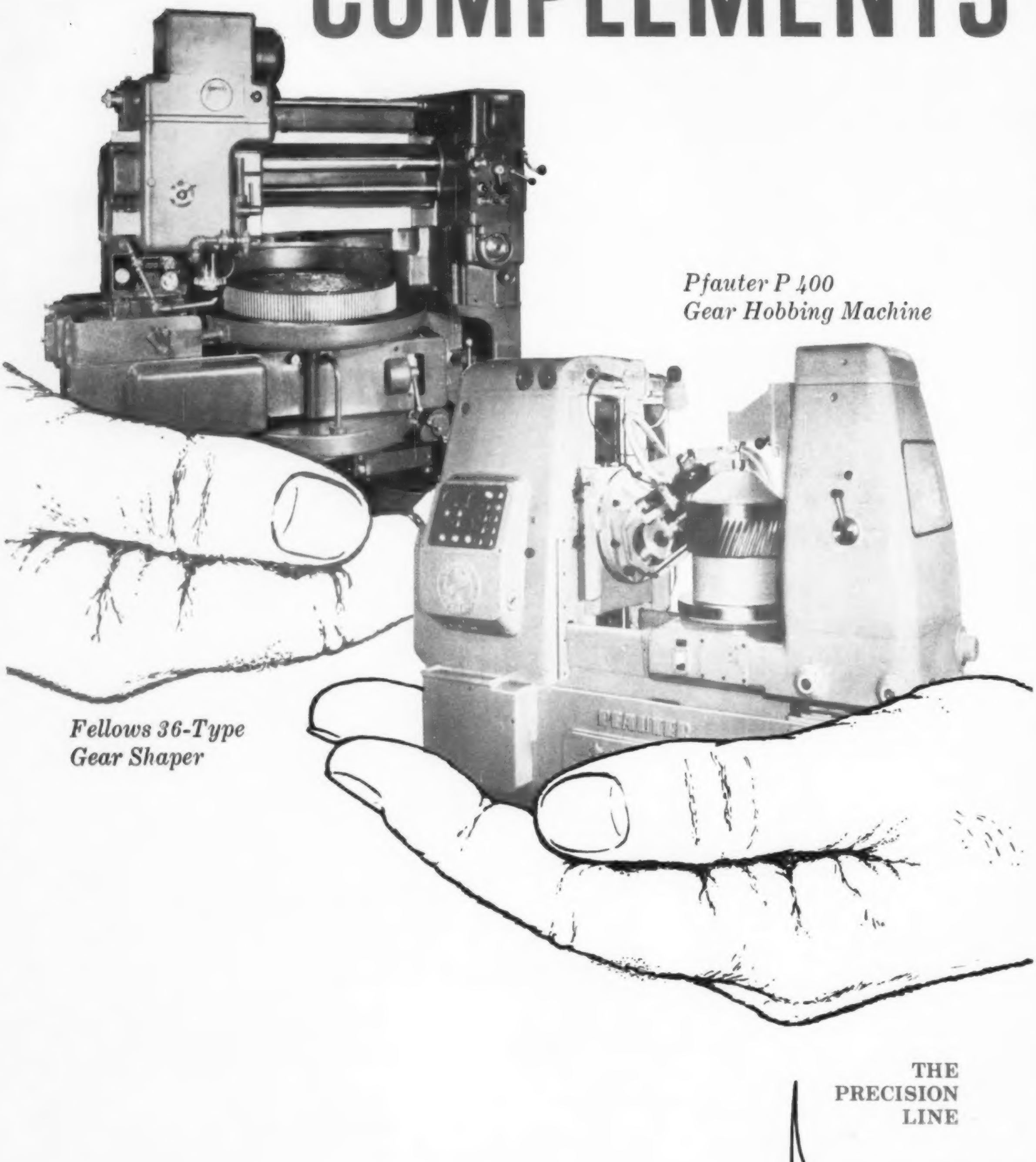


Thread Rolling Machines

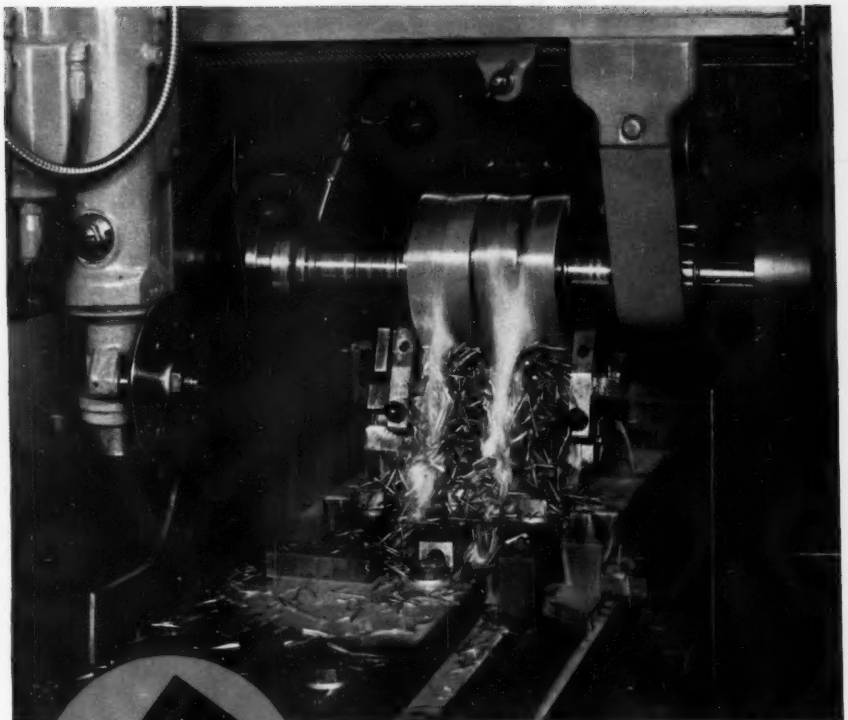
541

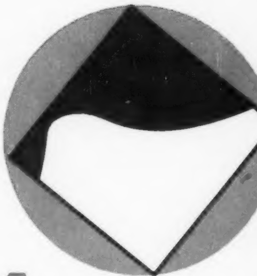

LANDMACO

# PERFECT COMPLEMENTS

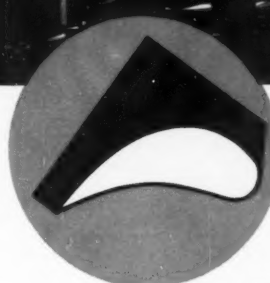



THE
PRECISION
LINE



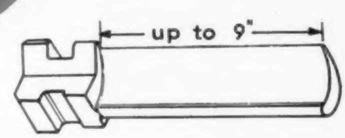


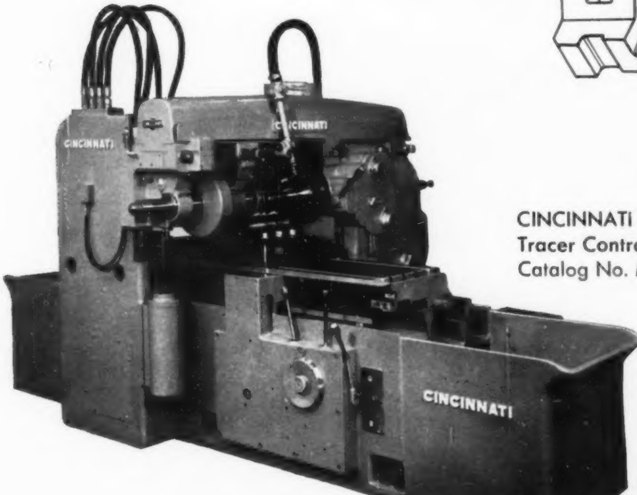
1st OPERATION



2nd OPERATION

Tracer control mechanism (left in the illustration), built-in automatic backlash eliminator, and automatic deflection compensator for the overarm are prominent feature-advantages in this HyPowermatic setup . . . down-milling the airfoil section of turbine blades; up to 9" length of blade in one cut.




CINCINNATI No. 430-184
Tracer Controlled HyPowermatic Milling Machine.
Catalog No. M-1909-1.

**The HyPowermatic Family**

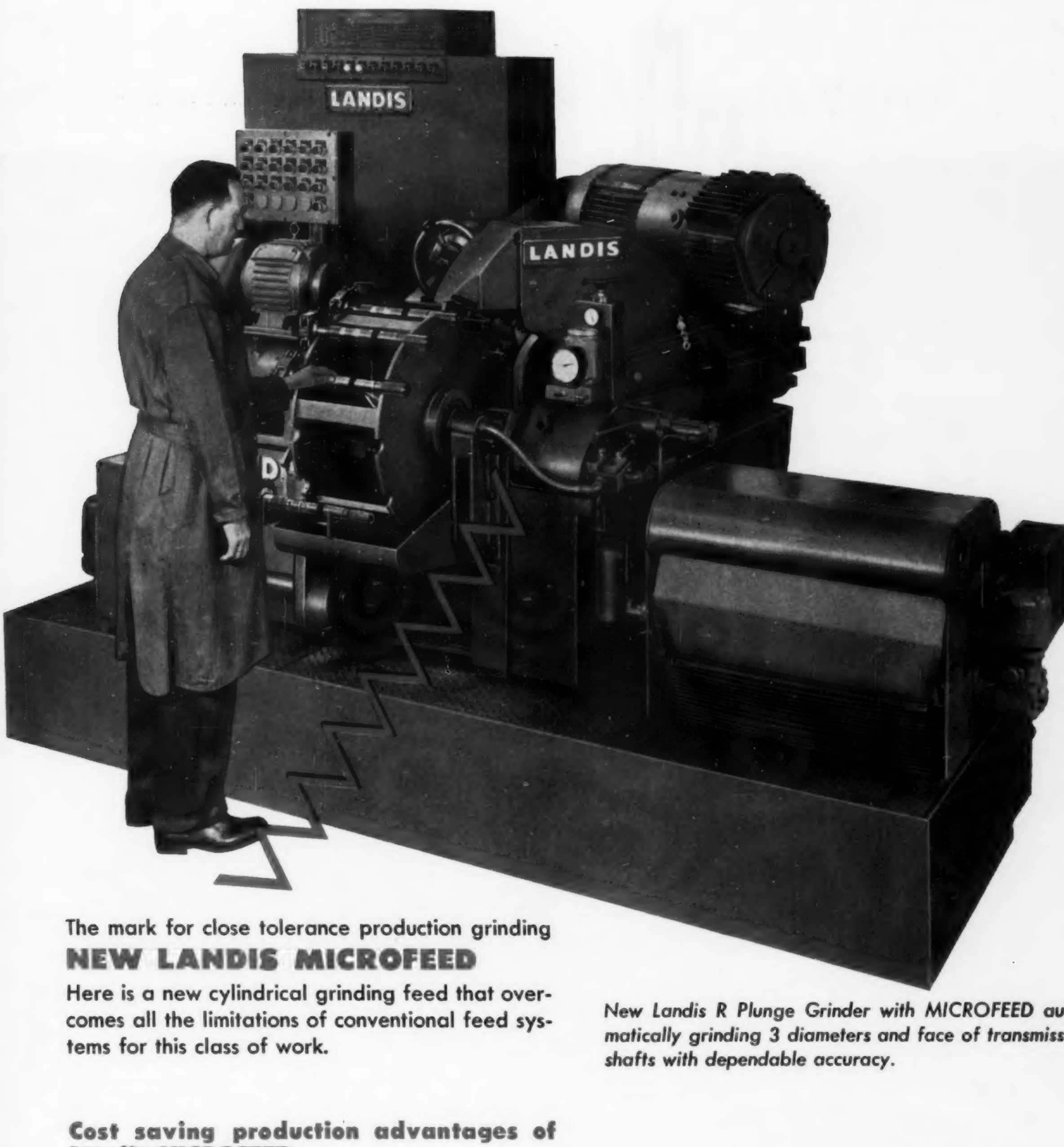
Two types: 1) for conventional milling operations; 2) for tracer controlled milling operations. Plain and duplex styles. 42 sizes of each. Table travel 36" to 168". 7½ hp to 50 hp spindle drive. Sixteen spindle speeds 40 to 1 ratio. Infinite number of table feeds.

DIE SINKING MACHINES • CUTTER AND TOOL GRINDERS

**MILLING MACHINE DIVISION**
**The Cincinnati Milling Machine Co.**
**Cincinnati 9, Ohio**



For more data, circle this page number on inquiry card




The mark for close tolerance production grinding

## NEW LANDIS MICROFEED

Here is a new cylindrical grinding feed that overcomes all the limitations of conventional feed systems for this class of work.

*New Landis R Plunge Grinder with MICROFEED automatically grinding 3 diameters and face of transmission shafts with dependable accuracy.*

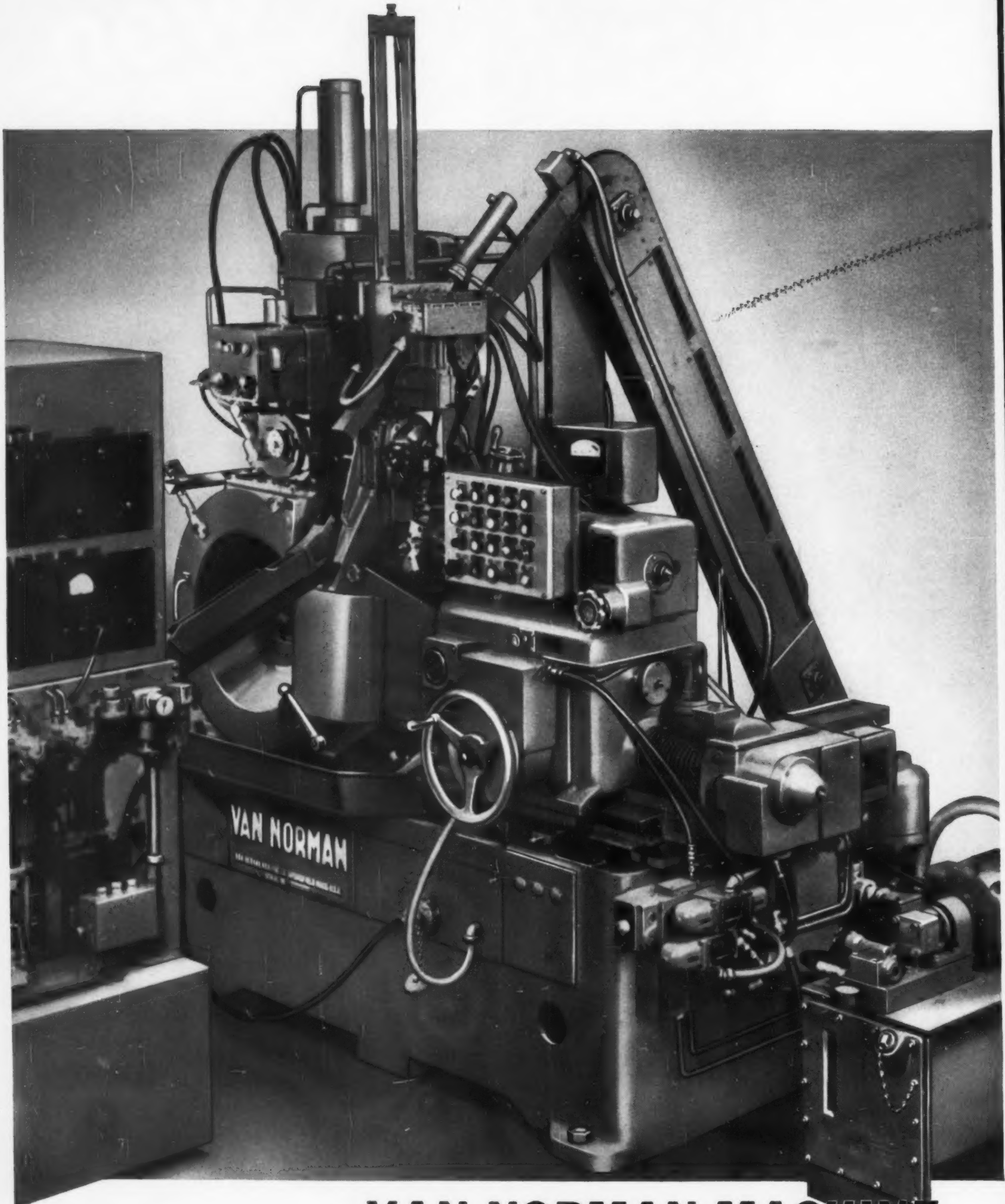
### Cost saving production advantages of Landis MICROFEED

- automatically compensates for wheel wear and machine temperature variations
- eliminates manual re-adjustments of wheel feed due to wheel and machine variables
- eliminates costly rejects and reworking
- easy to set feed reduces set-up time

# LANDIS

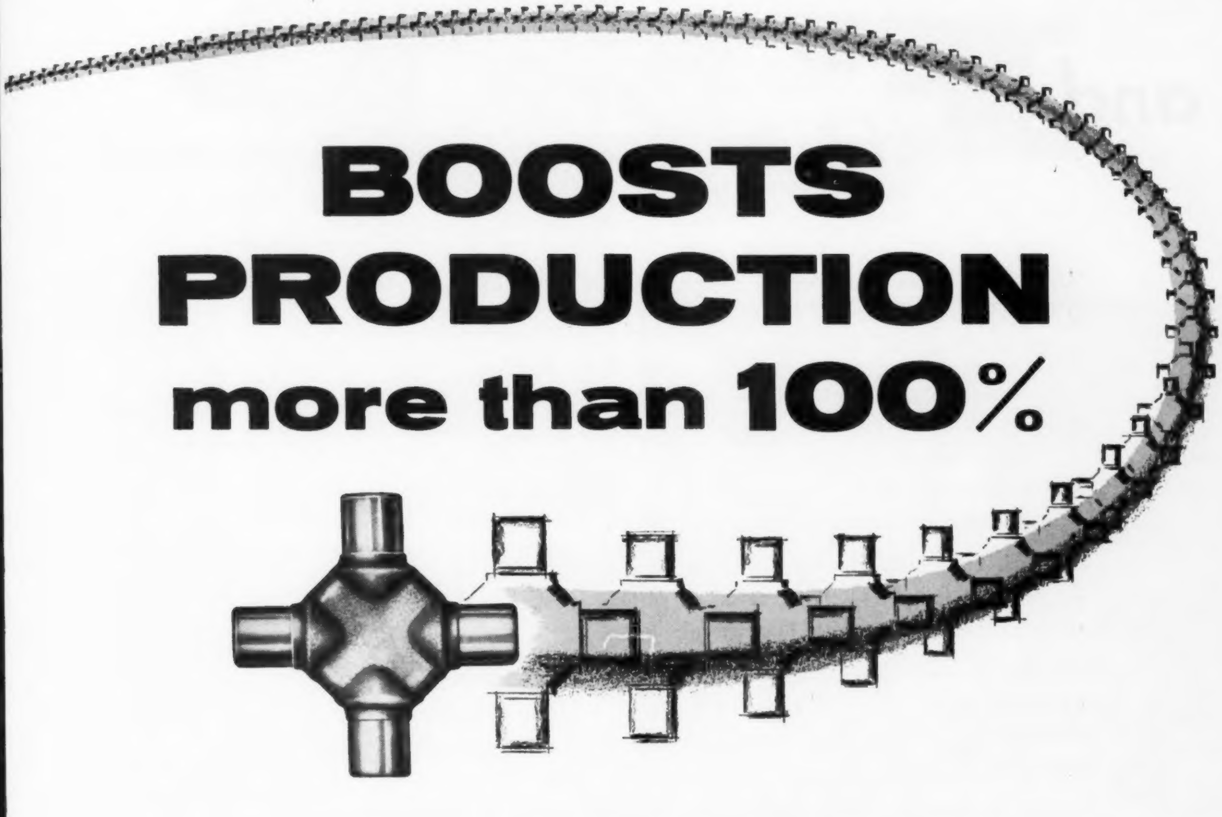
**precision grinders**

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA


VAN NORMAN

*Automotive Parts Manufacturer . . .*

# BOOSTS PRODUCTION more than 100%



## WITH THE VAN NORMAN 2C DIVERSIMATIC CENTERLESS

A leading Detroit auto parts maker had a problem. He was producing close tolerance universal joints — very satisfactorily as to finish *but* only at the rate of from 70 to 170 per hour. He needed greater production.

**His solution?**

Van Norman 2C Diversimatic Centerless Grinders.

**The result?**

This manufacturer is now turning out 250 an hour. *And*, when these precision parts leave the Van Norman 2C Diversimatic Centerless, they are completely ground and gauged to tolerances of .0003 of an inch or less.

**What made this possible?**

Van Norman design and engineering know-how which enabled them to produce a 2C Diversimatic, equipped with crush dresser, a special loading and indexing fixture, in conjunction with a special non-mar hopper belt loader and gauging device.

This is but one more example of how Van Norman helps tool engineers throughout industry reduce production costs. We welcome an opportunity to help *you* reduce your cost. Send in your specifications for a cost-saving Van Norman quotation.

**COMPANY**

***A DIVISION OF VAN NORMAN INDUSTRIES, INCORPORATED***

VN

*Don't wait . . . for extra profit install a Van Norman machine now! They are available in many purchase plans . . . Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate up to 10 years. Conditional Sales Contracts not available to Export.*

*T.M. Reg. U. S. Pat. Off.

# U.S. Press Room Equipment

## and FPP full profit potential

U. S. Press Room Equipment is designed for "F.P.P." — to help make press operations more profitable for you . . . to give to each press maximum flexibility and efficiency.

In many cases, press room productivity depends upon the flexibility of your equipment. The wider the range of material your presses can handle, the more productive and profitable they can be. When you combine this wider range of production with increased efficiency, you are approaching a production standard ideal for press rooms.

It is this standard — which has as its aim the realization of Full Press Room Profit for you — that dictates the manufacture and performance of every piece of U. S. Press Room Equipment.

For example, U. S. Slide Feeds are precision built units for the accurate feeding of coil stock into punch presses. They are adaptable to the feeding of one or more separate strips of wire or flat stock, either of regular or *irregular cross section.*

U. S. Flat Stock Straighteners and Two-Way Wire Straighteners are perfect complements to U. S. Slide Feeds. When teamed together they guarantee accuracy and contribute to prolonged die life.

***Write today for U. S. Bulletin No. 85M and learn how you can obtain maximum flexibility and efficiency for your present Press Room equipment—to give you your "F.P.P."***

**Some typical stock cross-sections readily accommodated by U. S. Slide Feeds.**

PRODUCTS

**U. S. TOOL COMPANY, INC.**

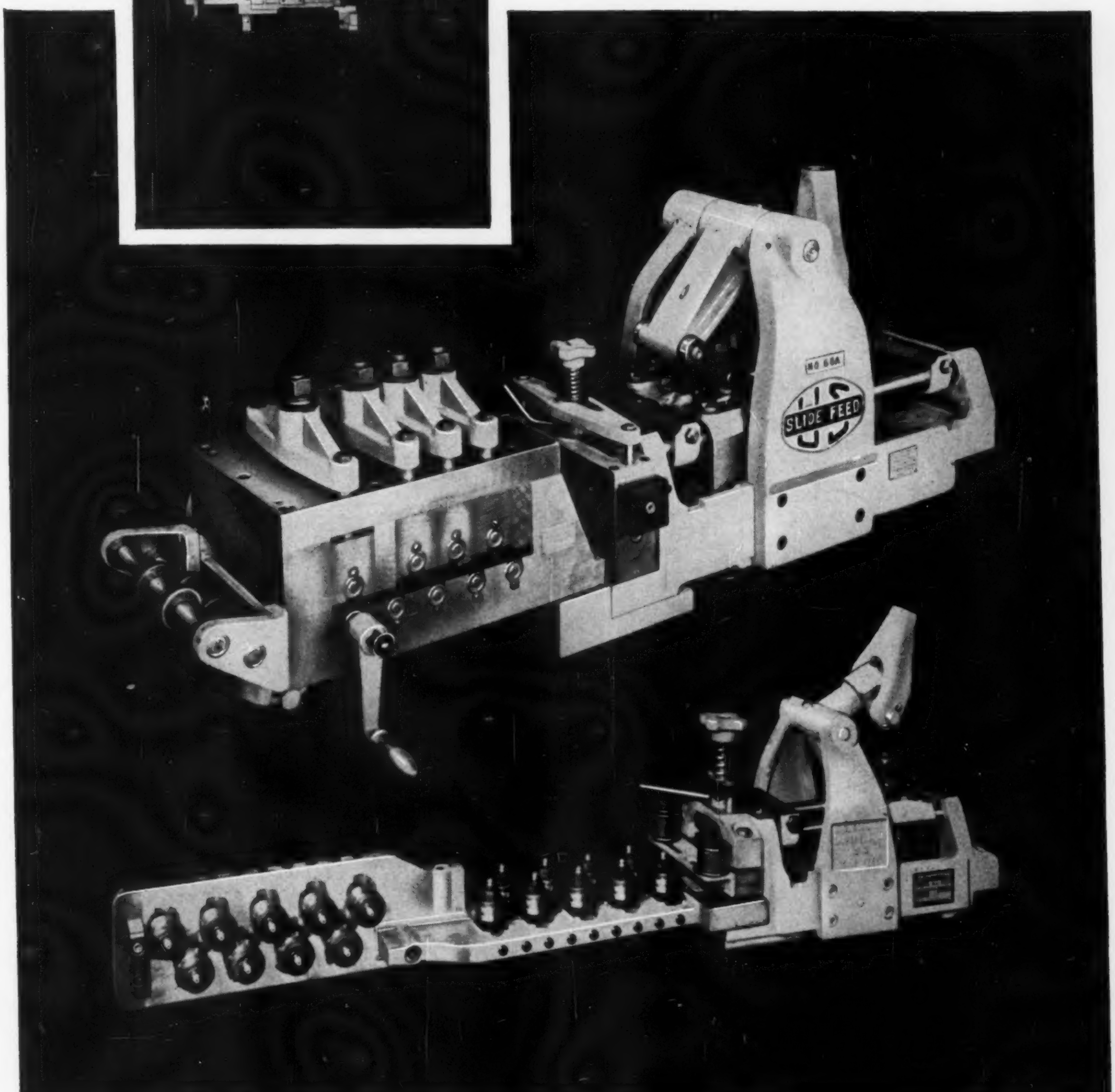
**AMPERE *(EAST ORANGE)* NEW JERSEY**

**U. S. Multi-Slides® • U. S. Multi-Millers® • U. S. Automatic Press Room Equipment • U. S. Die Sets and Accessories**

At left: **SF-1 U. S. Slide Feed with SS-07 Plain Stock Straightener mounted on conventional OBI press.**

Center illustration: **SF-68A U. S. Slide Feed with SS-27 Plain Stock Straightener. Maximum width capacity 6"— feed length adjustable up to 8".**

Lower illustration: **SF-O U. S. Slide Feed with Two-Way Wire Straightener (with nine rolls in each plane).**



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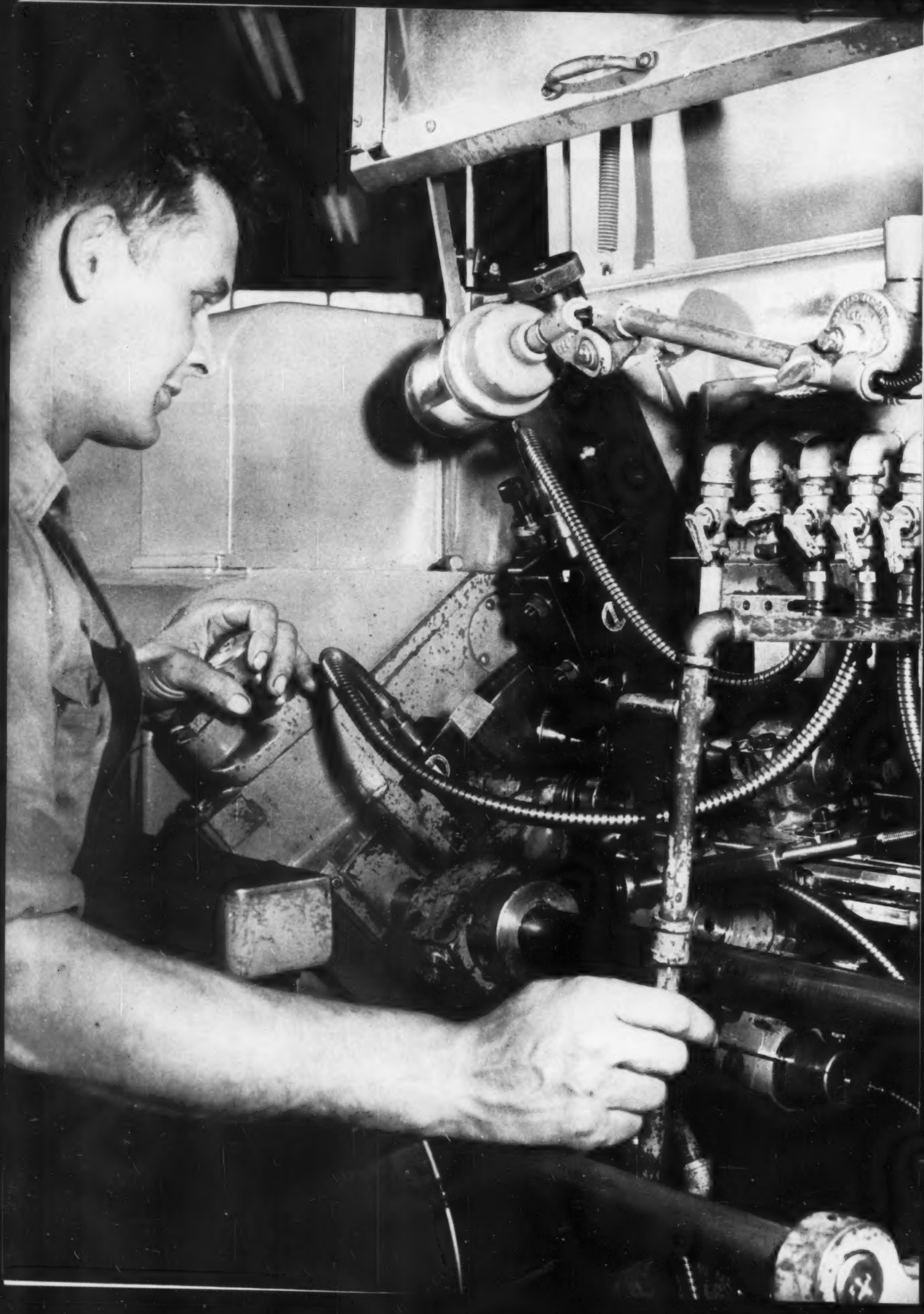


# "Our Warner & Swasey 5-Spindle Automatics put us in business on small lot precision jobbing work..."

REPORTS **TROY MANUFACTURING CO.** WELSHFIELD, OHIO

**Success of this progressive 6-man job shop has literally been founded on the ability of their 2¼-inch 5-Spindle Warner & Swasey Automatics to produce complex work accurately, in lots as small as 500 pieces with simple tooling and fast setups.**

Generally accepted job shop practice precludes the use of multi-spindle operations because of the economics involved in the "set-up time—lot size" relationship. This ratio is usually quite large on conventional automatics—which eliminates them from all but the longest run jobs.

However, Troy Mfg. has found the reverse to be true in the operation of their two Warner & Swasey 5-Spindle Automatics. As Mr. Cseplo, Manager of Troy Mfg., explained, "Quick set-ups permit us to profitably handle small lot work, and on jobs requiring tolerances between .001" and .002" we seldom scrap a piece which I think is good multi-spindle work. We handle an extreme range of work size and materials in short runs, and the accuracy and versatility of our Warner & Swaseys are invaluable assets to a job shop operator."

Warner & Swasey Multi-Spindle Automatics can substantially cut your machining costs on small and medium lot production—as well as on longer runs. To get the complete story of how these versatile machines can profitably fit into your production picture, call in your Warner & Swasey Field Representative, today.

**YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS . . . WITH A WARNER & SWASEY**

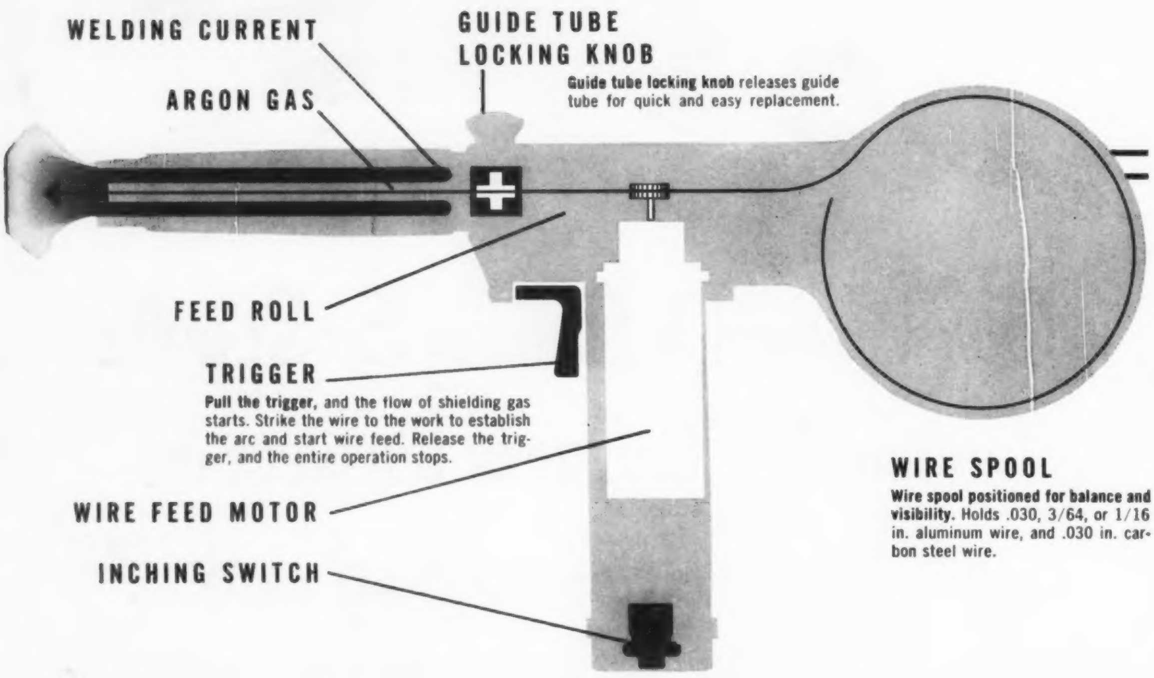
WARNER
&
SWASEY
*Cleveland*
PRECISION
MACHINERY
SINCE 1880



For more data, circle this page number on inquiry card

# Try LINDE'S New "SIGMETTE" Torch!

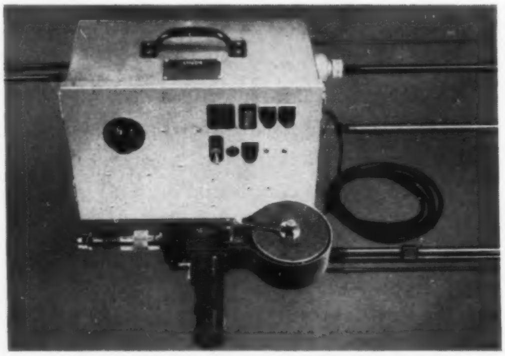
## –PORTABLE, COMPACT




**Here's the torch that goes to the job—lets you work in any position . . . in confined spaces . . . at distance remote from the power source!**

**Designed for Sigma welding of light metals, the "Sigmette" torch is compact and sturdy. Notice the thin silhouette and position of the spool for complete visibility. Torch and control are completely insulated and grounded—the operator is protected from electrically "hot" parts. And the only maintenance tool needed is a screwdriver!**

**Find out how Linde's new "Sigmette" torch can speed your operations, bring new economies through its advanced design features. For a free demonstration and detailed information, mail the coupon today or call the nearest Linde Office.**



**Complete unit**—torch weighs 3 pounds, 1 oz.; control weighs 19 pounds, 2 oz.; Current rating, 125 to 200 amp.; Welding power, direct current reverse polarity

**Dept. MY-4, Linde Company**
**Division of Union Carbide Corporation**
**30 East 42nd Street, New York 17, N.Y.**

☐ Please send complete facts on the new "Sigmette" torch.
☐ Please arrange to let me try it.

Name__________

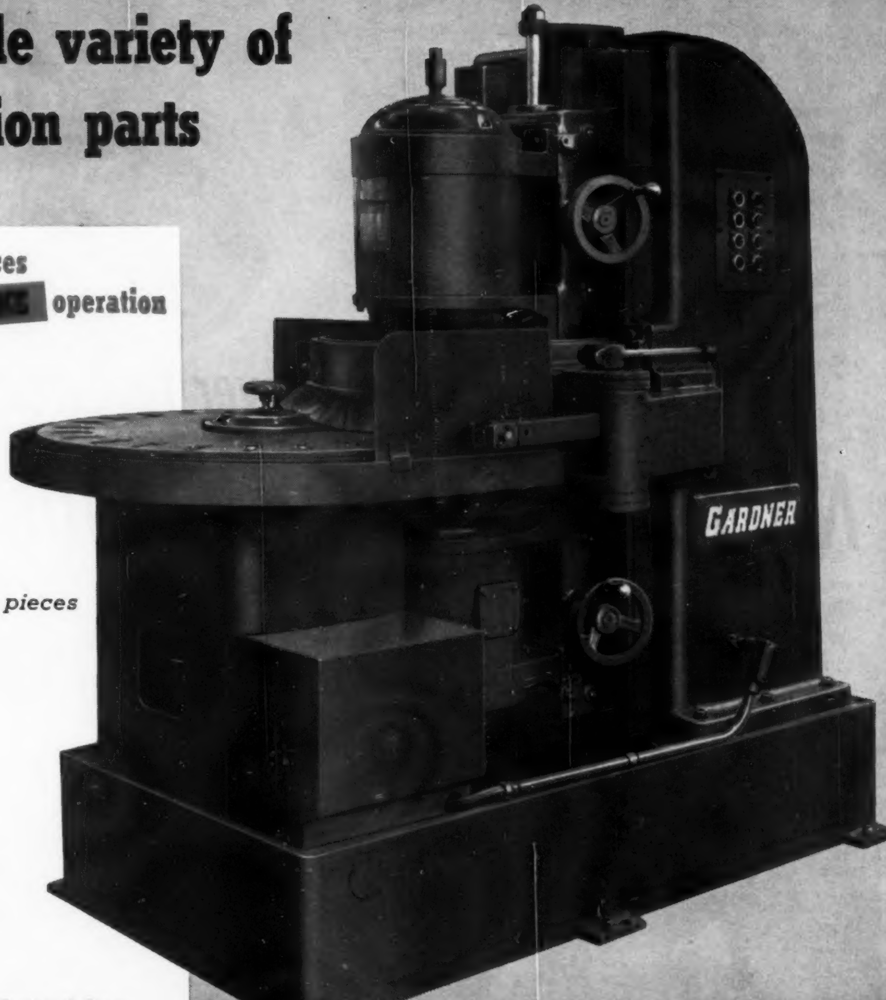
Firm Name__________

Street__________

City__________ Zone_____ State_____

Linde UNION CARBIDE

# Gardner 2V18 demonstrates versatility in grinding wide variety of small precision parts

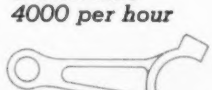



**TWO parallel surfaces precision ground in ONE operation**

*Counter pinion*
*2400 per hour*

*Upper and lower pole pieces*
*250 per hour*

*Watch disc*
*4000 per hour*



*Connecting rod*
*900 per hour*

Gardner 2V18 Double Vertical Spindle Grinders lower costs with fast, accurate grinding. Interchangeable work carriers for parts of many shapes, assure profitable, flexible operation. Write for latest catalog.

Rotary work carrier assures high production grinding of both sides of small connecting rods.

# GARDNER

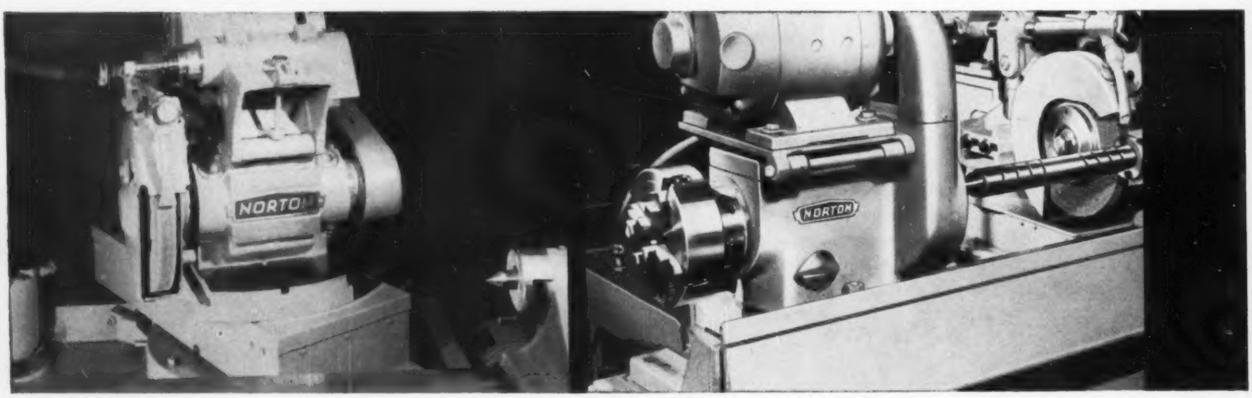
**precision disc grinders**

BELOIT, WISCONSIN

## *With fast change-over features like these...*

# *Norton Universal Grinders*

## *do more...save more*

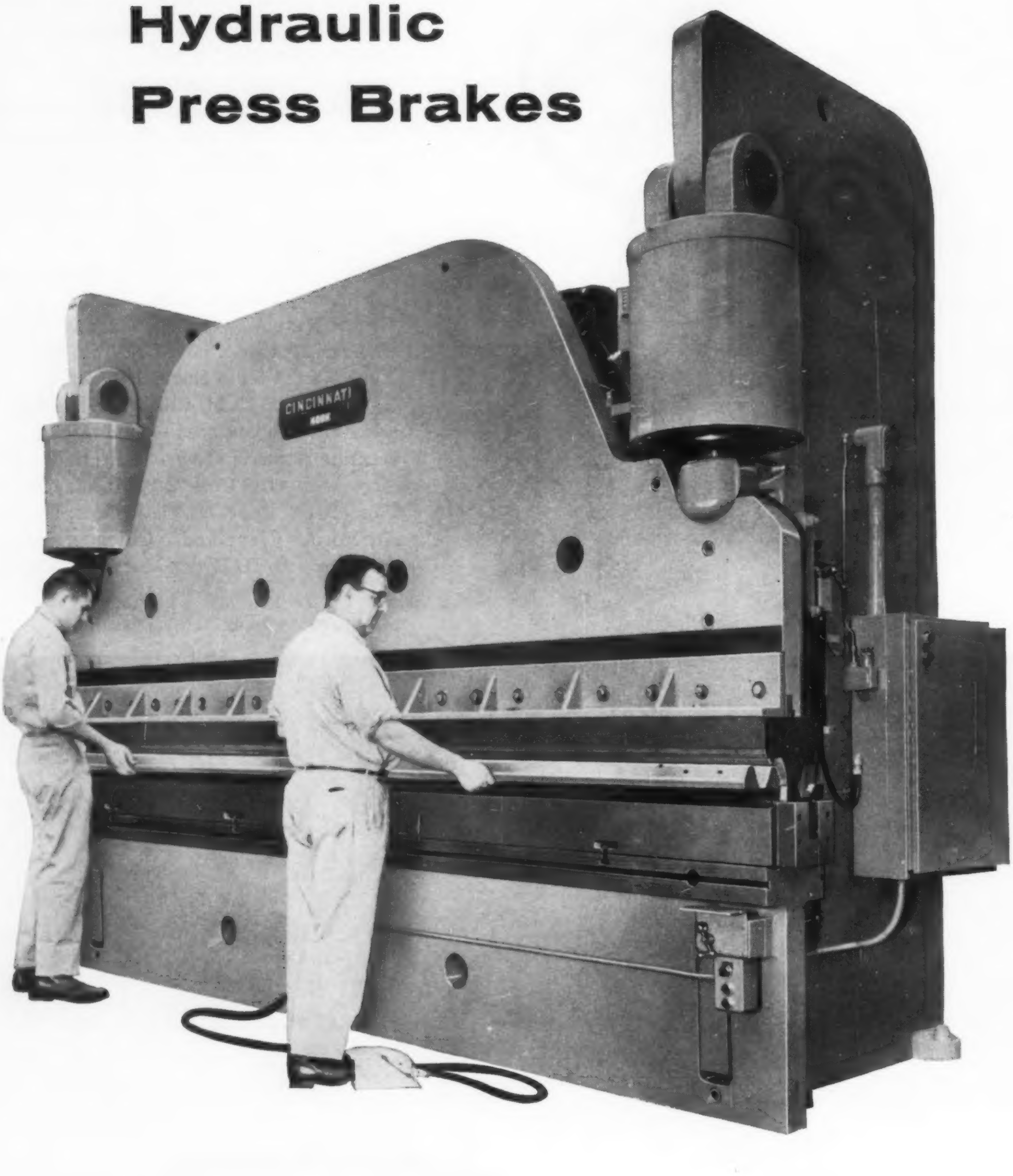



The flexible grinding wheel head swivels above and below the slideways, permitting independent angular settings of wheel and feed — giving you the widest job range.

You can change from dead center to chucking work with minimum effort. Chuck remains mounted at back end of headstock when grinding "on centers".

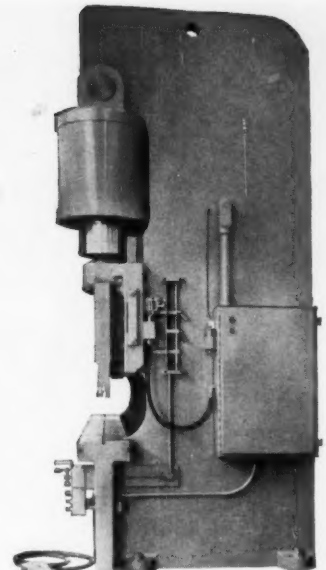
For more data, circle this page number on inquiry card

# 3 basic advantages of CINCINNATI® Hydraulic Press Brakes



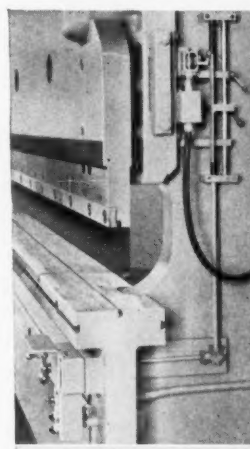

Cincinnati® Hydraulic Press Brakes, now available in 300, 400, 500, and 600 ton capacities, are not substitutes for Cincinnati® Mechanical Press Brakes. Where high production, maximum accuracy, and greatly increased tonnage at the bottom of the stroke are required, Cincinnati Mechanical Press Brakes remain unchallenged. However, where accuracy requirements are not extremely critical, where high speed is not necessary and where long strokes are desirable, Cincinnati Hydraulic Press Brakes offer important advantages—some entirely new to the field of hydraulic press brakes.

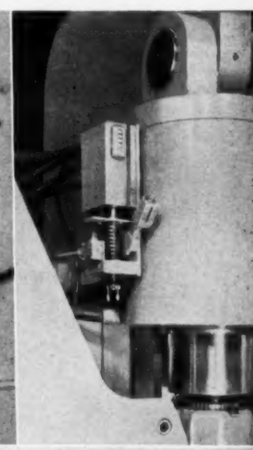
# 1 Accuracy



A special Cincinnati feature is extra heavy housings which extend above the cylinders, providing a means for their unique clevis mounting. This gives true center-line loading: vertical thrust of the cylinders is carried by the housings *without welds or bolts*. The cylinders are connected to the ram with ball joints and are self-aligning in all directions. Binding of pistons and ram slides cannot occur. In addition, deep beds and rams, and large radii at all stress points minimize deflection and insure maximum accuracy. With Cincinnati interlocked construction, the bed is supported directly by the housings *without* load bearing welds.

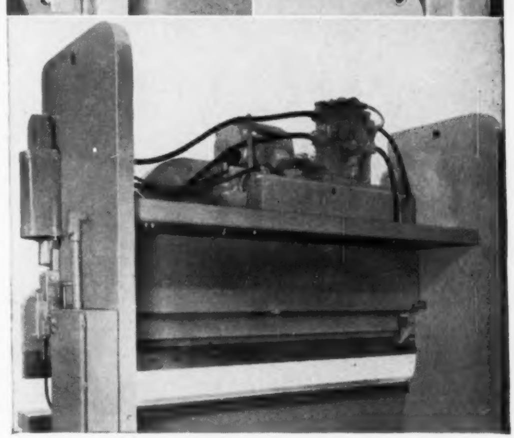
# 2 Convenience





All controls are at right end of the machine, within easy reach of the operator. The bottom stroke-stop adjusting crank is on the front of the bed. Micrometer registers are provided to indicate both the bottom stroke-stop and ram tilt adjustments, a great convenience in setting dies on initial or repeat setups. Tonnage, stroke length, and ram position are easily set. Indicator lights tell direction ram is moving or ready to move. Machine cannot overload: it reverses when loaded to any given tonnage setting.

# 3 Economy



Greatly simplified maintenance and reduced cost result from Cincinnati's exclusive hydraulic manifold block, which brings valves and piping together in one compact assembly. The usual maze of valves, pipes and fittings is eliminated. High pressure joints are reduced to a minimum, which means important maintenance economies, year after year.

Write Dept. D for informative Bulletin HB-1.

**Shapers / Shears / Press Brakes**

**THE CINCINNATI SHAPER CO.** Cincinnati 11, Ohio, U.S.A.



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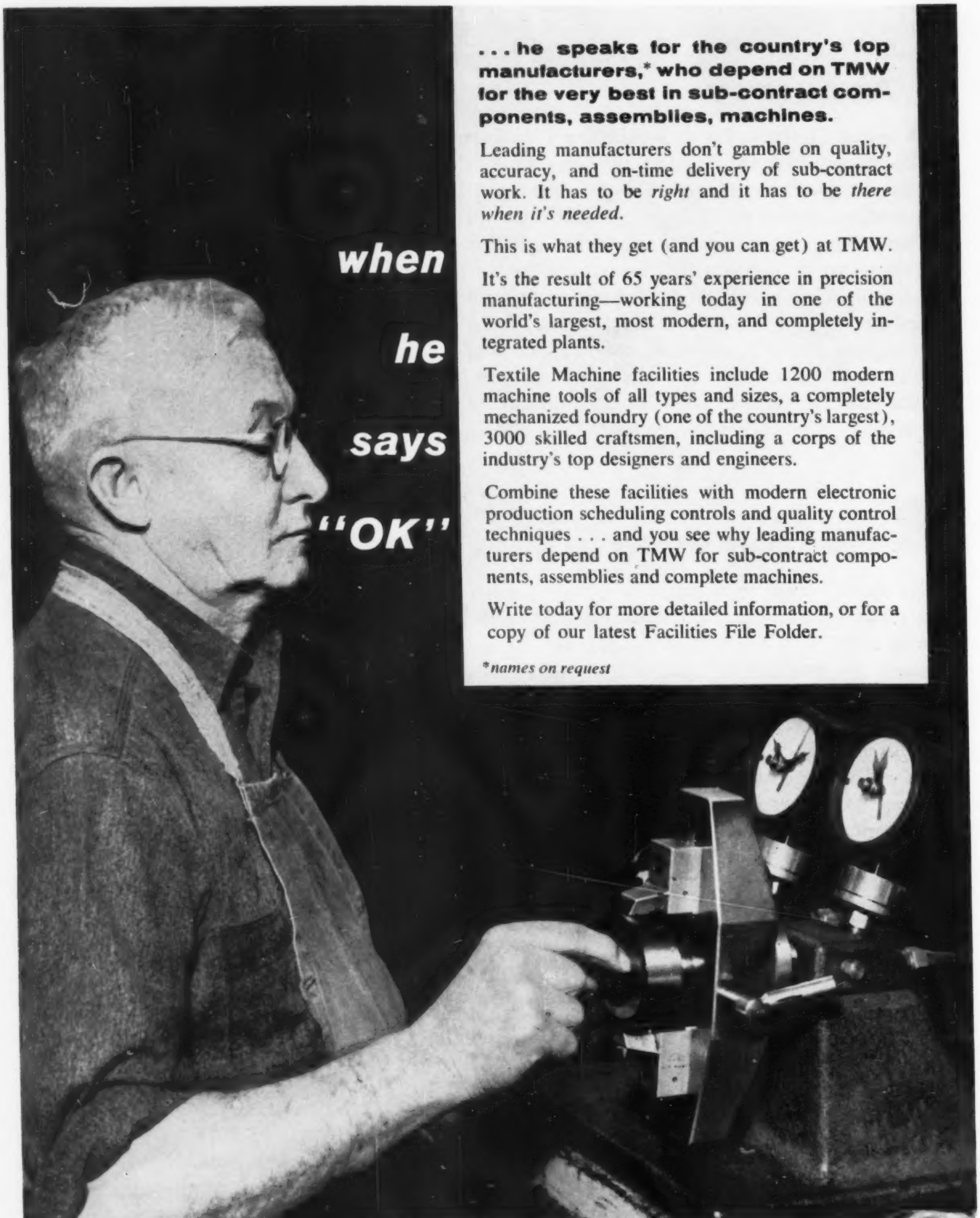



**. . . he speaks for the country's top manufacturers,* who depend on TMW for the very best in sub-contract components, assemblies, machines.**

Leading manufacturers don't gamble on quality, accuracy, and on-time delivery of sub-contract work. It has to be *right* and it has to be *there when it's needed.*

This is what they get (and you can get) at TMW.

It's the result of 65 years' experience in precision manufacturing—working today in one of the world's largest, most modern, and completely integrated plants.

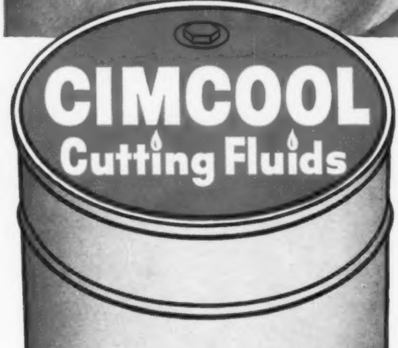
Textile Machine facilities include 1200 modern machine tools of all types and sizes, a completely mechanized foundry (one of the country's largest), 3000 skilled craftsmen, including a corps of the industry's top designers and engineers.

Combine these facilities with modern electronic production scheduling controls and quality control techniques . . . and you see why leading manufacturers depend on TMW for sub-contract components, assemblies and complete machines.

Write today for more detailed information, or for a copy of our latest Facilities File Folder.

**names on request*

**TEXTILE MACHINE WORKS**
*Contract Division • Reading, Pennsylvania*


FOR 100% OF ALL METAL CUTTING JOBS

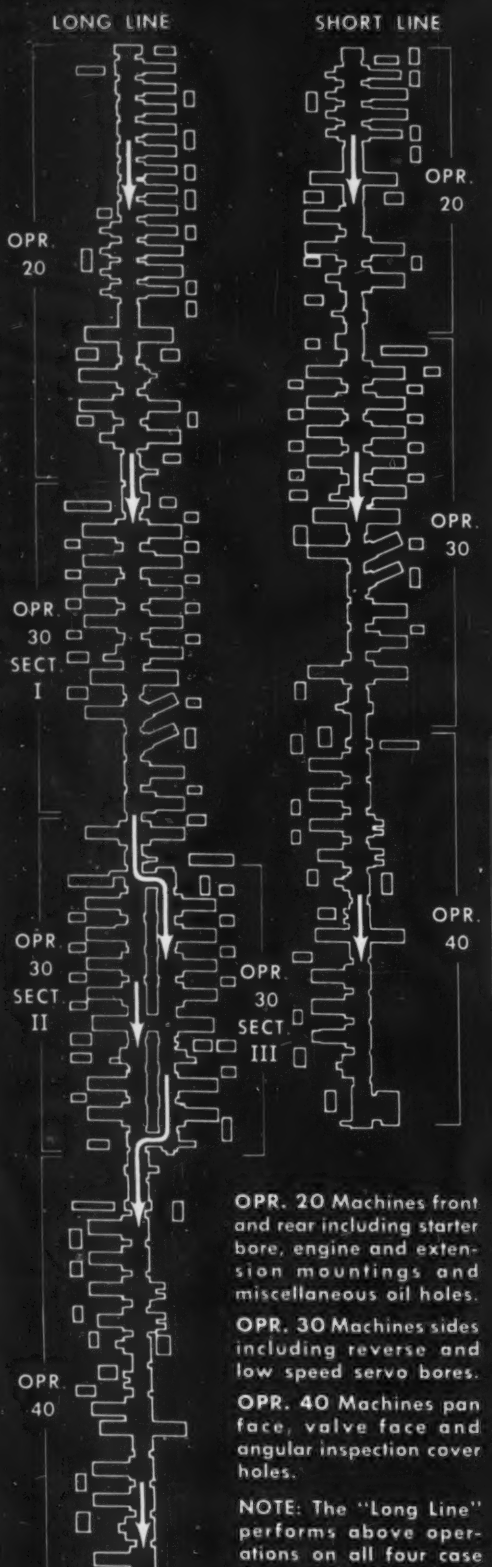
**Production-proved products of The Cincinnati Milling Machine Co.**

**CIMPERIAL**—*newest* in the famous, industry-proven line of CIMCOOL° Cutting Fluids!
**CIMCOOL S2 Concentrate**—The pink fluid which covers 85% of all metal cutting jobs.
**CIMPLUS**—The transparent grinding fluid which provides exceptional rust control.
**CIMCUT Concentrates (AA, NC, SS)**—For every job requiring an oil-base cutting fluid.
**ALSO—CIMCOOL Tapping Compound—CIMCOOL Bactericide—CIMCOOL Machine Cleaner.**

For full information on the complete family of CIMCOOL Cutting Fluids, call your CIMCOOL Distributor, or contact Cincinnati Milling Products Division, Cincinnati 9, O.

°Trade Mark Reg. U.S.Pat. Off.

# Complete Product Mix Processed On New Cross Transfer-matics



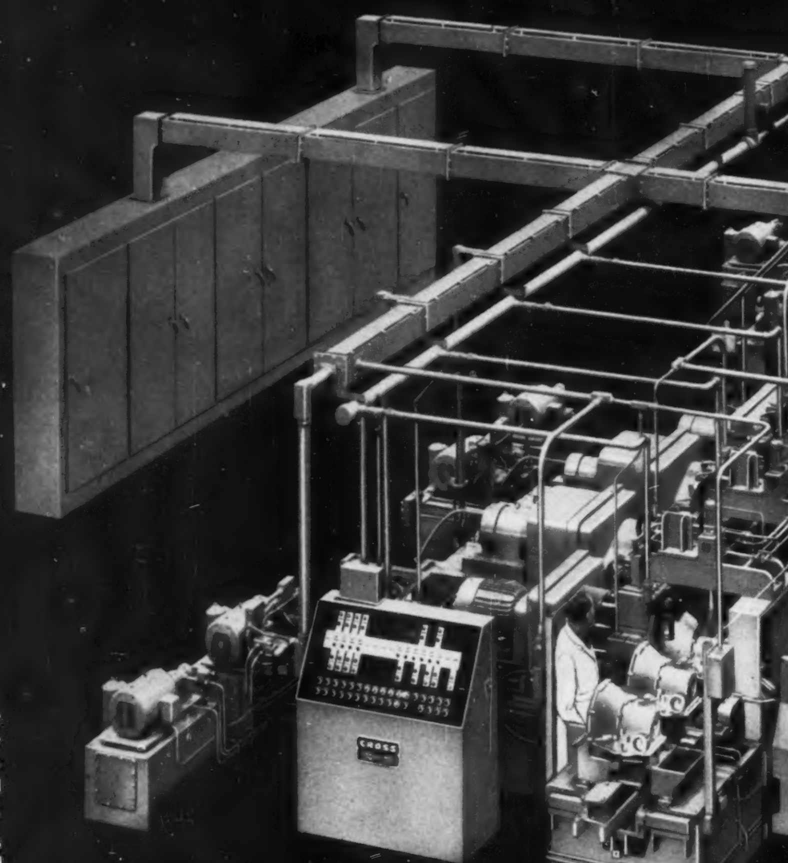

**OPR. 20** Machines front and rear including starter bore, engine and extension mountings and miscellaneous oil holes.

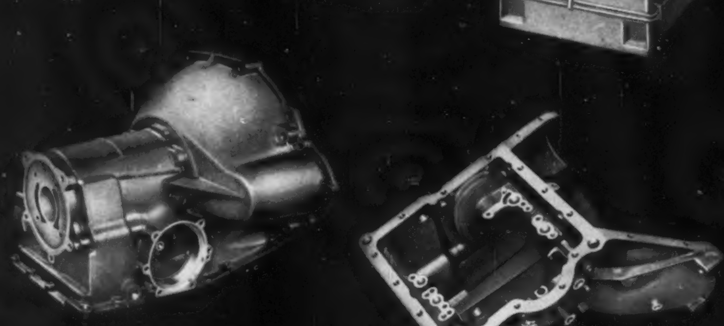
**OPR. 30** Machines sides including reverse and low speed servo bores.

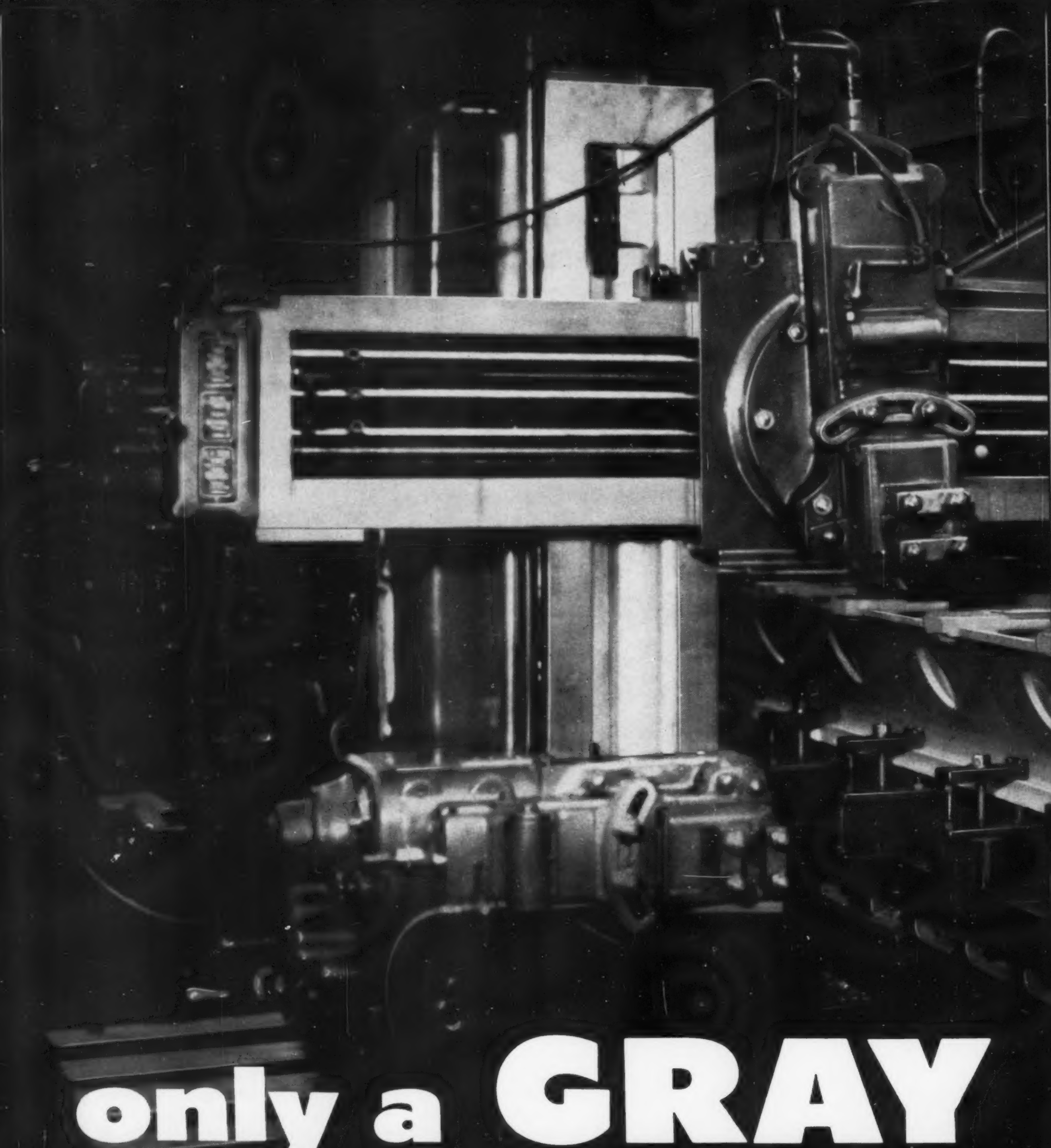
**OPR. 40** Machines pan face, valve face and angular inspection cover holes.

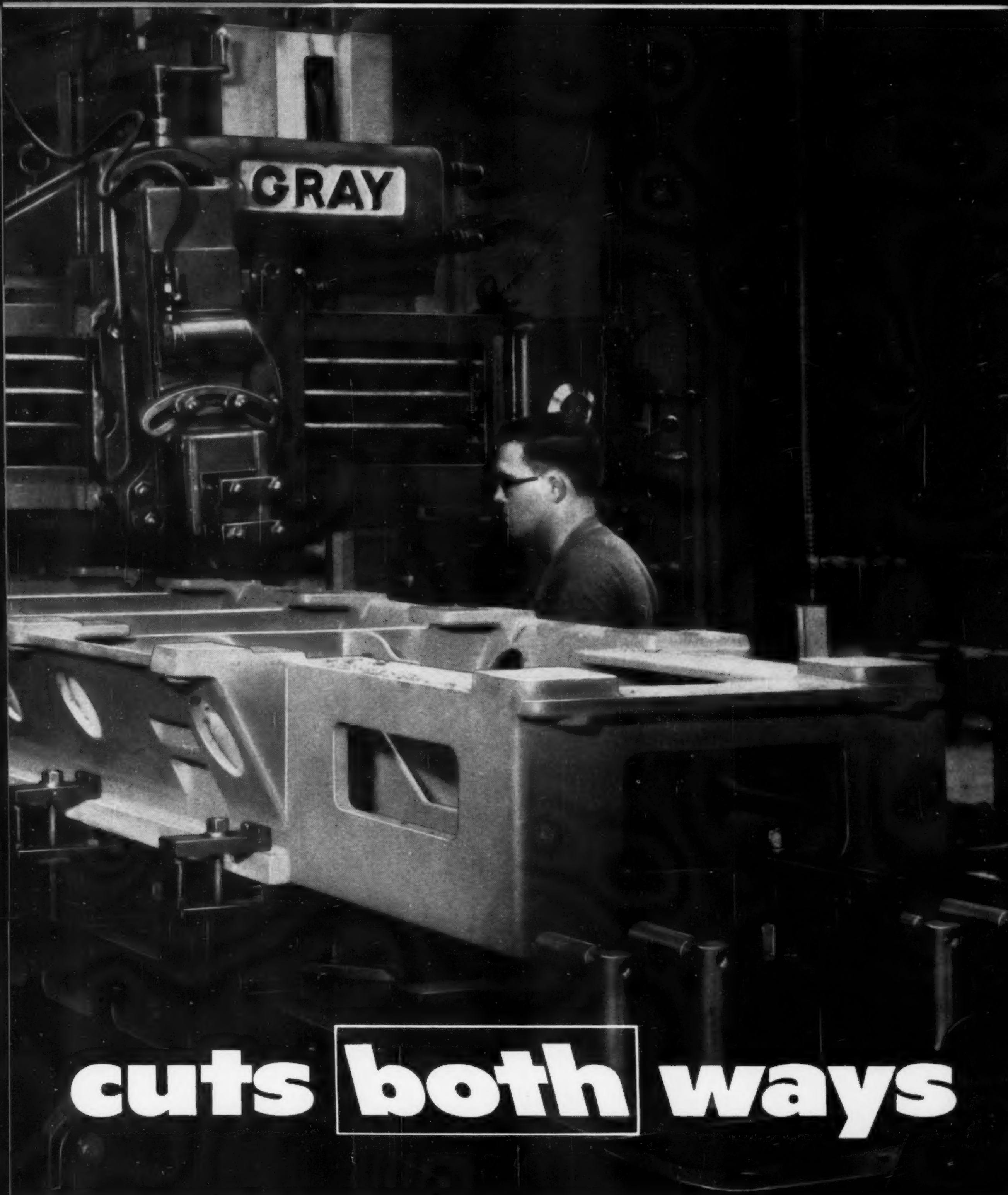
**NOTE:** The "Long Line" performs above operations on all four case designs. The "Short Line" performs these operations on only a single case design.

Floor Plan Layout of Two New Cross Sectionized Transfer-matics




only a GRAY




### double-cutting

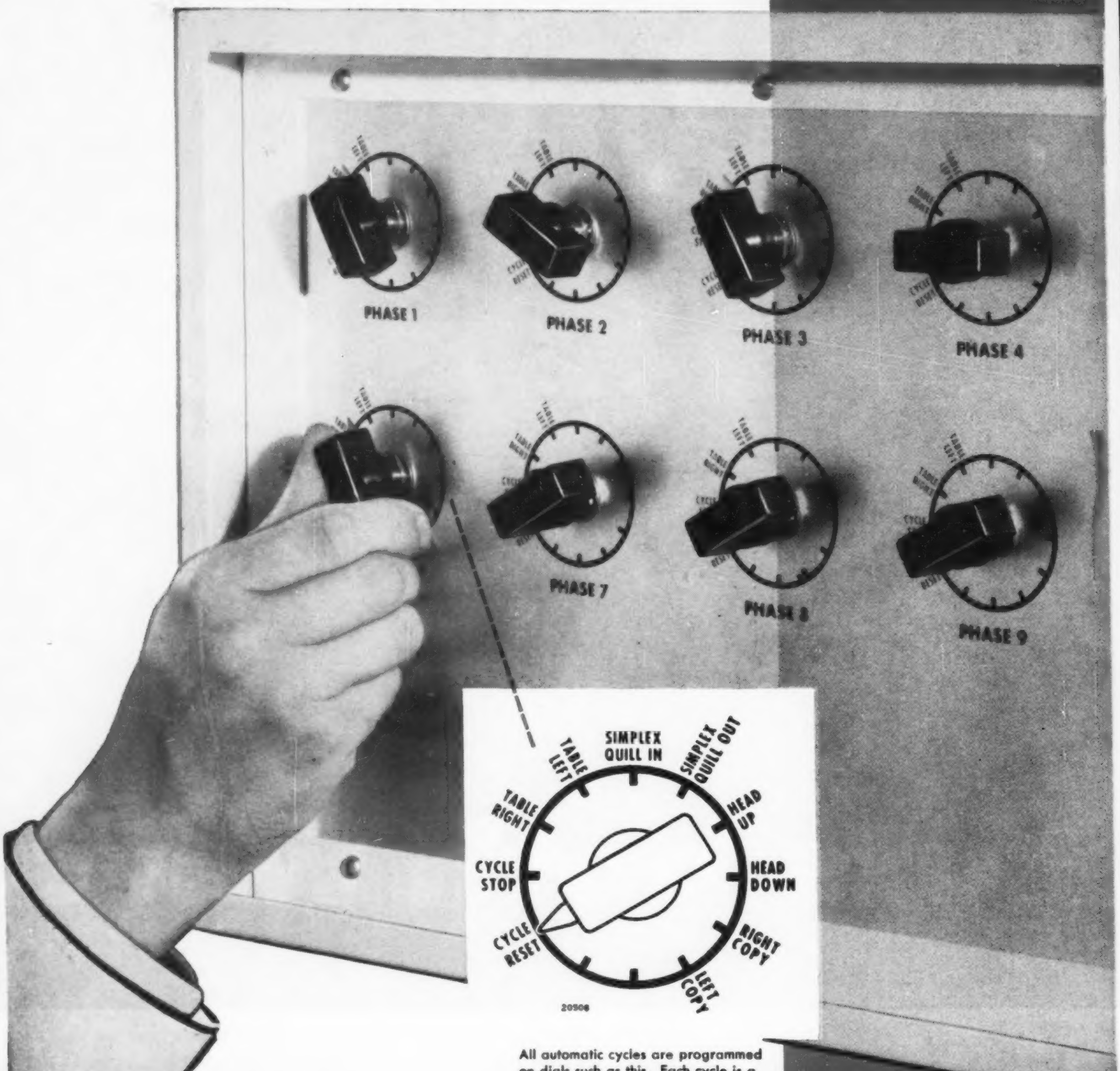
The flick of a lever, the touch of a button permits double-cutting. Elimination of the idle stroke insures the world's most efficient flat surface machining. Only simple carbide tools are required.

### triple-cutting

Rough and rough-finish plane at the same time. Rough by double-cut planing and simultaneously rough-finish with a single point tool. Then finish plane without a tool change.

### cross planing

Eliminates extra settings by cross planing the occasional keyways, chamfered corners, and other troublesome small cross surfaces that formerly added hours to your set-up time.


PHASE 1
PHASE 2
PHASE 3
PHASE 4
PHASE 7
PHASE 8
PHASE 9
SIMPLEX QUILL IN
SIMPLEX QUILL OUT
TABLE LEFT
TABLE RIGHT
HEAD UP
HEAD DOWN
CYCLE STOP
CYCLE RESET
RIGHT COPY
LEFT COPY
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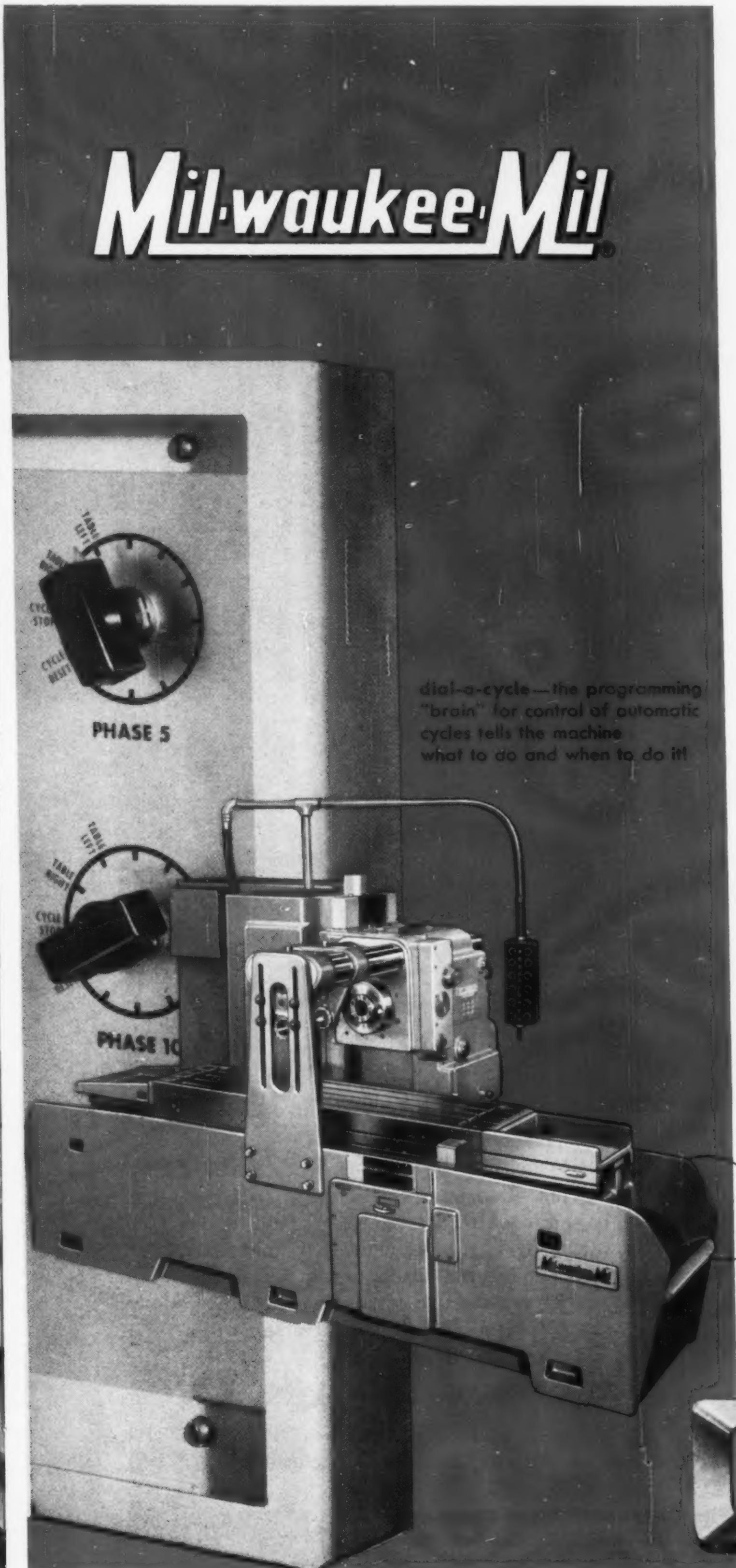



**THE FULLY AUTOMATIC BED-TYPE MILLING MACHINE WITH *EXCLUSIVE* DIAL-A-CYCLE**

## All you do is dial automatic cycles to slash idle cutter time!

Here's a remarkable machine that cuts out operator guesswork! He merely reads a workpiece blueprint and establishes machining sequence with successive phase-switch dials.

From there on in, dial-a-cycle programs and controls each and every machine function — automatically.

Result — the machine is earning its keep practically every minute . . . is seldom idle while the operator stops to figure out his next move. You get more finished pieces in less time . . . faster write-off on machine cost.

**For details on any of the 72 standard models (Simplex and Duplex) 7½ to 30 hp, write for bulletin MM-58.**

Standard Machine Division
**KEARNEY & TRECKER CORP.**
6788 West National Ave., Milwaukee 14, Wis.

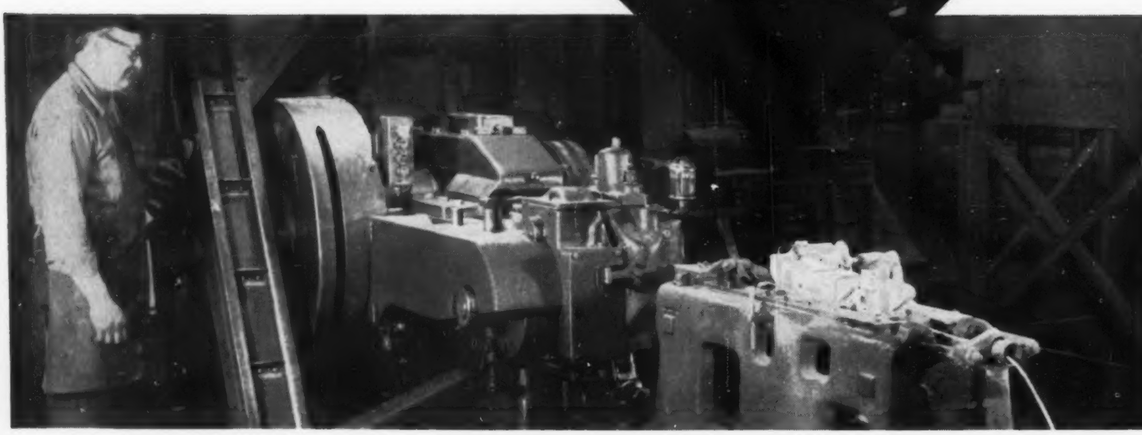
*Available on Tool-Lease!*

*Designers and Builders of Precision and Production Machine Tools Since 1898*

KEARNEY & TRECKER
MILWAUKEE

# MEL-TROL®

## at work



You get good, predictable performance from a solid cold heading die only when the die steel you use is uniformly tough and strong through the core of the bar. But the core of the bar can only be as uniform as the core of the ingot it came from.

That's why *Carpenter* developed the MEL-TROL process. MEL-TROL uses the best quality control tools made, precise melting techniques, and an exclusive, patented ingot design, to turn out tool and die steels—such as H-9 Double Header for cold heading dies—that are more uniform through the center and have greater freedom from segregation and flaws than any other tool and die steels sold today.

A call for H-9 Double Header to your nearest *Carpenter* representative—right now—is your very best answer to the problem of unpredictable performance in cold heading dies.

*Carpenter* STEEL

**The Carpenter Steel Company**
*Main Office and Mills, Reading, Pa.*
*Alloy Tube Division, Union, N. J.*
*Webb Wire Division, New Brunswick, N. J.*
*Carpenter Steel of New England, Inc., Bridgeport, Conn.*



**For more data, circle this page number on inquiry card**

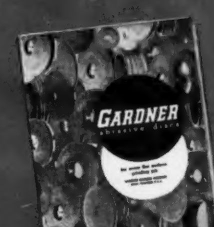
# Gardner cylinder wheel with new BKGR bond increases production from 70,000 parts to 127,000

***actual competitive test gives user "best wheel life ever"***

**production facts**

Part: . . . . . . . . . . . . Exhaust flanges
Machine:
Vertical Spindle Surface Grinder
Abrasive: . . . . . . . . . . 18" x 5" x 10"
Production:
127,000 parts per wheel
Dressing Time:
Only two dressings during entire life

*Investigate the profit possibilities of Gardner grinding for your production. Call your Gardner Abrasives Specialist, or write for Abrasive Catalog AC-57.*




**GARDNER**
abrasive discs
BELOIT, WISCONSIN

# ARMSTRONG

## TOOL HOLDERS

### A Correct Tool for Every Lathe Operation

You can save time (and money) by ensuring that your machine tools are equipped with *adequate numbers* of the correct ARMSTRONG Tool Holders. The ARMSTRONG System of Tool Holders includes correctly designed tools for *every* standard operation on lathes, shapers, and planers, and for many operations on turret lathes and screw machines. By utilizing the ARMSTRONG System of Tool Holders, you can reduce tooling costs, eliminate down time in tooling up, operate your machine tools at maximum feeds and speeds.

ARMSTRONG Tool Holders are long-lasting tools. They are strong beyond need, handy and efficient, profitable to use, and are readily available from your local ARMSTRONG Distributor.

**Check over your ARMSTRONG Tool Holder needs.**
**Write for literature.**

*If you do not know the name of your local ARMSTRONG Distributor, inquire when asking for literature.*

**ARMSTRONG BROS. TOOL CO.** 5213 W. ARMSTRONG AVE. CHICAGO 46, ILL.



Circle page 33 on Inquiry Card →

PRODUCTION POINTERS from GISHOLT

More cost-cutting IDEAS— to help you

## BODINE ELECTRIC CUTS TIME 65% WITH THIS SETUP

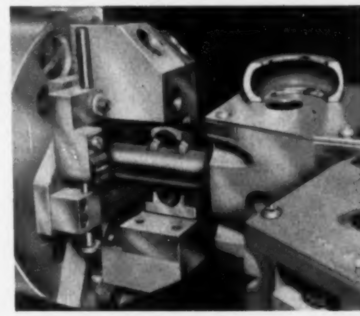
### Automatic drive, smart tooling on No. 3 ram cut time and costs

Here are several production ideas you may find useful in your work. Bodine Electric, a well-known manufacturer of fractional h.p. motors in Chicago, Ill., has applied them on two Gisholt MASTERLINE No. 3 Ram Type Turret Lathes—cutting machining time an average of 50% on eight different parts. Gross production totals more than 80,000 units per year.

Replacing four obsolete turret lathes, both No. 3 rams are equipped with hydraulic drives that control all machine functions, including selection of speeds and feeds, reverse feed, stop and reverse of spindle, etc. The hydraulic drive actually converts the hand-operated turret lathes into AUTOMATIC CHUCKING TURRET LATHES, permitting one operator to handle both machines. Other plus factors include longer tool life and more uniform quality through use of correct speeds and feeds.

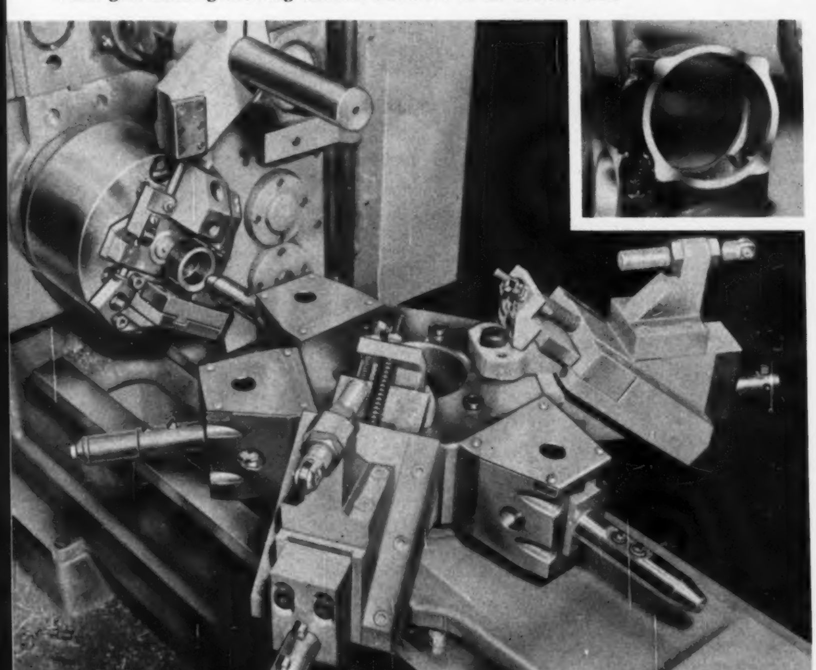
On the typical cast iron worm gear housing shown, time was cut 65% on the boring and facing operation alone. Parts are held in a 10", 2-jaw, air-operated fixture. A manually operated swinging stop mounted on the fixture face is used for length location and then moved out of the way after the part is chucked to provide clearance. The automatic cycle is started and the operator moves to the second machine while hex turret tools rough- and finish-bore, straddle-face and chamfer at the front and back, and bore a relief between the front and back bores. F.t.f. time, 2.5 minutes.

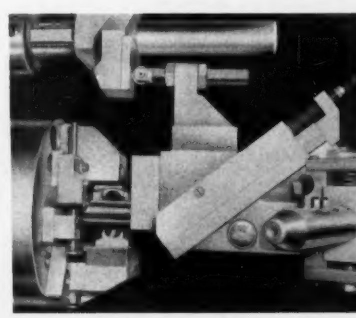
***Automatic cycle controlled by hydraulic drive cuts time 65%, doubles operator productivity. Smart tooling eliminates "cutting air" and improves accuracy by machining front and back of work simultaneously.***



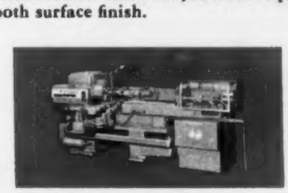
**Special pivoting boring bars** are used for rough- and finish-boring. As hex turret feeds forward, tapered end of boring bar enters straight bore of chuck pilot bushing. This raises pivoted bar aligning it with machine centerline and positions tools vertically to machine front and back bores simultaneously. Runout between 2¾" diameter front and back bores is held within .0015" with this method. Relief between front and back bores and front chamfer is also handled in this manner on another turret station.

Hydraulic drive and special hex turret tooling simplify and speed machining, assure greater accuracy, concentricity and parallelism between front and back faces. (Inset) Close-up of worm gear housing showing surfaces machined in 2.5 minutes f.t.f.





**Automatic slide tools** used for rough and finish-straddle-facing front and back, and chamfering back I.D. On forward feed of hex turret, a roller on movable slide contacts a dead stop bracket on overhead pilot bar. Slide is forced up incline on continued forward feed of hex turret, engaging tools that straddle-face front and back simultaneously. Reverse feed on finish cut provides required smooth surface finish.



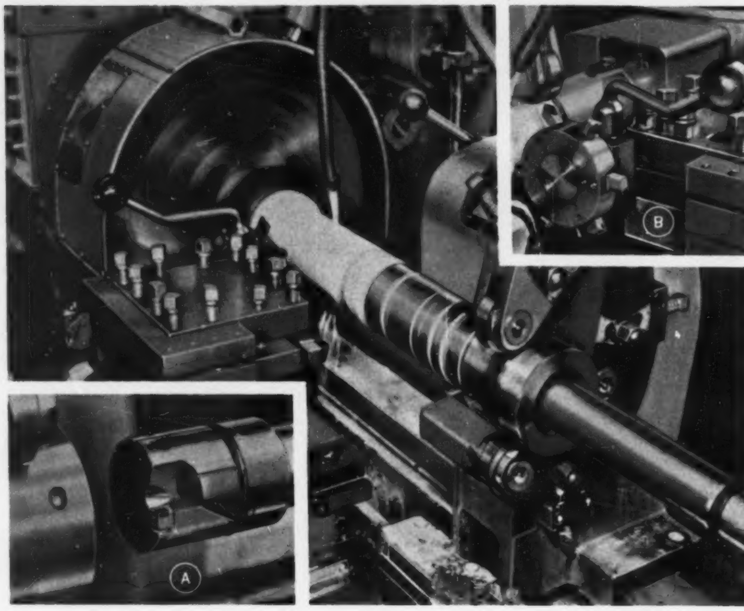
# SETUP SAVES BAKER OIL TOOLS $30,000 PER YEAR

**Smart tooling on MASTERLINE 3L Saddle Type Turret Lathe cuts time 25%**

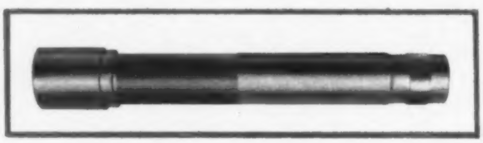
You will want to study this setup used by Baker Oil Tools, Inc., Los Angeles, Calif. It saves over $30,000 per year in the machining of centrifugally cast, iron retainer production packer bodies.

Several "extras" contribute to the dramatic saving: an indexing tool holder on the square turret, with six preset tools; special gun drilling and burnishing tools on the hex turret; a full-length lead screw for threading from either turret; an open-side steadyrest support for maximum accuracy in the long bore.

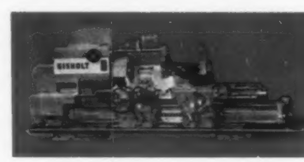
Here's how these "extras" are used on the small, 3½" O.D. end of the 31"-long body, shown. Held on the large-diameter end, the small bore is chamfered, then live center supported from the hex turret while the O.D. is turned from the square turret for steadyrest support. Other square turret tools, including those on the indexing holder, finish-machine the outside diameters, face the end and, using the lead screw threading attachment, cut an 8-pitch V-thread near the small end and an 8"-long, .015"-deep, 16-pitch buttress thread near the large end. During finish-threading, the gun drill removes ¼" stock per side, taking the rough cast hole to within .001" of finished size in one pass. The roller burnishing tool sizes and finishes the bore to a 32 micro-inch RMS finish or better. Time f.t.f., 41 minutes.




Preset tools on indexing holder complete O.D. turning while gun drill works in bore. (Inset A) Gun drilling head. Cutter life is 200 pieces per grind. (Inset B) Each preset tool on indexing tool holder has cutting life of 400 pieces.



Completely machined retainer production packer body. Used in oil and gas wells at depths to three miles or more, with pressures up to 10,000 p.s.i. and temperatures over 300 degrees.




***Setup saves over $30,000 per year. Simultaneous use of hex and square turret tools, plus indexing tool holder, cuts time 25%. Gun drilling and burnishing tools eliminate boring, reaming, and subcontracted honing.***

# DoALL SUPERFINISHES TO IMPROVE PRODUCT QUALITY

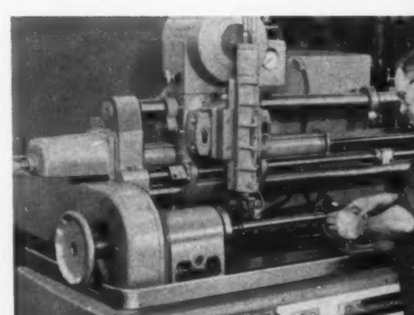
**General-purpose 52A Superfinisher handles wide range of parts**

How to improve product quality and still hold costs down is a major problem. Superfinishing is one of the answers. It is now part of a continuous product improvement program at The DoALL Company, Savage, Minn. Many components used in DoALL's line of machine tools, including band machines, surface grinders and others, are now being Superfinished.

Here's how the seal surfaces on piston rods used in hydraulic cylinders are improved by Superfinishing. Formerly the piston rods were ground to a 16 RMS surface finish, polished and chrome-plated. Still, some leakage took place past the rod seals.

Partial Superfinishing revealed grinding defects such as lobes and chatter. Now these defects are eliminated by grinding to a 30-50 RMS finish and then Superfinishing to a "controlled" 7-8 micro-inch RMS finish. All of the piston rods are now Superfinished, although in some cases it is restricted to the rod-seal area.

***Superfinishing eliminates polishing prior to chrome-plating. Savings balance cost of Superfinishing operation. Improved rod surface gives longer seal life, eliminates field reports of leakage at seal.***



Superfinishing improves product quality, provides better performance and reduces maintenance costs. Here the operator checks the final O.D. dimension on finished part.

**ASK YOUR GISHOLT REPRESENTATIVE ABOUT FACTORY-REBUILT**

# GREENLEE BALANCES FOR MAXIMUM QUALITY WORK

## 31S Balancer measures and locates unbalance on wide variety of high-speed parts

Looking for a quick, accurate way to get vibration-free performance from high-speed rotating parts or assemblies? Check this setup used by Greenlee Bros. Company, Rockford, Ill.

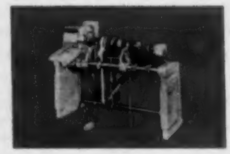
The 31S handles a variety of high-speed spindles, boring units, cutter head rotors, etc., used on Greenlee's well-known line of woodworking equipment and machine tools. Job-lots range from one to 15 pieces, weights up to 300 pounds.

A special cradle fixture is used with bushing inserts to handle variations in length and diameter.

A cope unit arbor for the Greenlee No. 545 Double End Tenoner Woodworking Machine is a typical part. It operates at sustained speeds of 3600 to 7200 r.p.m., and performs such delicate operations as shaping panels and coping. Balancing eliminates vibrations that cause imperfections on the finished wood surfaces.

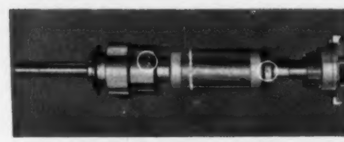
The arbor is placed in the cradle and is belt-driven. The strobe lamp and amount meter show the exact angle and amount of unbalance in each correction plane—indicating exact drill depth required for correction. F.t.f. time, just four minutes.

Unbalance in each correction plane is corrected within the specified tolerance on a drill press. Only minimum spot-checking is needed to inspect for balance since the 31S has proved consistently that correction can be made within the specified tolerance on the first try.

31S Balancer with extra-length bed and cradle fixture handles short or long parts on job-lot basis. Note strobe lamp and direct reading amount meter, in same visual plane, permitting operator to observe angle and amount of unbalance simultaneously.

*The 31S is ideal for fast, accurate job-lot or production balancing. Features quick setup, ample capacity and ease of calibration, permitting unbalance measurement in terms of correction methods used.*



Cope unit arbor for Greenlee No. 545 Double End Tenoner Woodworking Machine. Note correction for unbalance made by drilling at observed angle to indicate depth in bushings (encircled) to left and right of armature body.

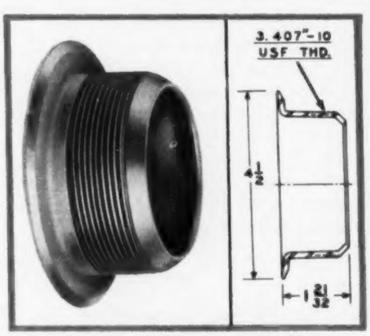
# HOW CRI-DAN SOLVES A TOUGH THREADING PROBLEM

## Single-point threading saves time, cuts tool and material costs

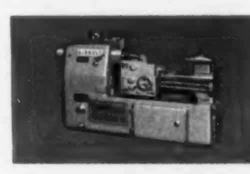
Want to turn your costly, troublesome threading jobs into money-saving operations? Then study the time-saving advantages of this setup on a CRI-DAN Model "B" Semi-Automatic, Single-Point Threading Machine.

**The job:** cutting a 3.407"-diameter, 10 TPI thread on a 303 stainless steel sink mounting flange used in home garbage disposal units. Work is held in the I.D. by a 3-jaw, 6" air chuck. Full-contour type chuck jaws, taper-turned to conform to the draft angle of the stamping, minimize possible distortion. No coolant is required as a single-point carbide threading tool, held in a heavy-duty tool block, makes 18 fast, automatic passes, completing the job in just 42 seconds.

The job was formerly handled on a thread milling machine but heavy cutting pressure required the use of heavy gage steel to prevent flexing.




The CRI-DAN single-point tool threading method reduces cutting pressure, so lighter gage stock is suitable—cutting material cost. Tooling costs are cut because a single-point carbide tool replaces a thread milling cutter. Maintenance cost is also low as the single-point tool produces more than 95 pieces between grinds.



Workpiece and drawing showing threading performed in 42 seconds. Savings in time and tooling costs alone are more than enough to justify the purchase of the CRI-DAN "B" machine.

*CRI-DAN features inexpensive, single-point carbide tooling, semi-automatic operation for low-cost, high-production threading; provides more accurate lead and thread form on all types of internal or external threading operations.*

MASTERLINE GISHOLT SINCE 1887

GISHOLT

**MACHINES WITH NEW MACHINE GUARANTEE**

MASTERLINE GISHOLT SINCE 1887

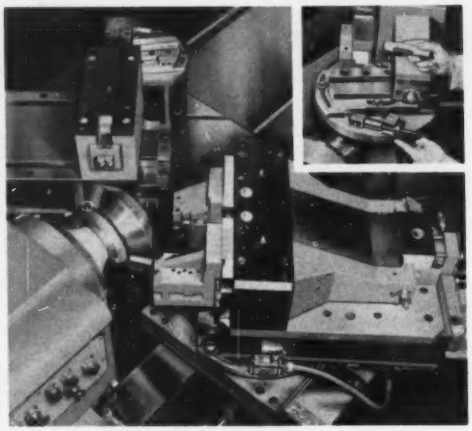
# HARNISCHFEGER CUTS TIME 30% ON 27 BEVEL GEAR SIZES

## Swivel base slides, gage bushings speed setups on No. 24

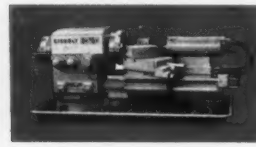
Interested in cutting angular machining costs where stock removal is heavy and tolerances are held to "minutes"? This setup, used by Harnischfeger Corporation, Milwaukee, Wis., will show you how.

Here one basic setup on a Gisholt MASTERLINE No. 24 Automatic Chucking Lathe handles 27 sizes of steel bevel gear blanks. Machining time is cut an average of 30%. Back angles, front counterbores and faces are machined, and sharp O.D. corners are broken, by straddle tools in two special blocks on the front independent slide. The blocks swing open for tool relief. At the same time, the face cone angles are generated by a cam-controlled tool in a sliding holder on the rear independent slide. F.t.f. time on the typical 12¾"-diameter, 5½"-wide part shown is only 7½ minutes.

Special tooling reduces setup time. *Expanding mandrel* holds work in bore, drives with key or against back lug. Eight mandrels handle all parts; bushings compensate for diameter changes. *Front carriage top* adjusts for fast transverse settings. *Independent slide* with swivel base mounts on carriage top and supports straddle tool blocks. *Independent slide* on rear carriage has swivel base. It supports special tool block with sliding tool holder, which is controlled by cam plate on angularly adjustable pedestal mounted on rear carriage top. *Gage bushings*, clamped between positive stops and swivel bases on independent slides, assure quick, accurate angular settings.



Completed part on mandrel, straddle tools on front independent slide, and face cone angle generating tools on sliding tool holder in block on rear independent slide. (Inset) Operator holds gage bushing, indicates how it slips on threaded shaft attached to swivel base. Shaft swings between swivel base and positive stop. Nut is tightened from opposite side to complete angle setting.



***Master gage bushings, swivel bases on independent slides and pedestal-mounted cam plate plus adjustable front carriage top cut change-over time 15%. Fast, automatic cycle provides maximum stock removal, highest efficiency.***

# HOW YOU CAN SAVE TIME AND CUT COSTS ON FIXTURE WORK

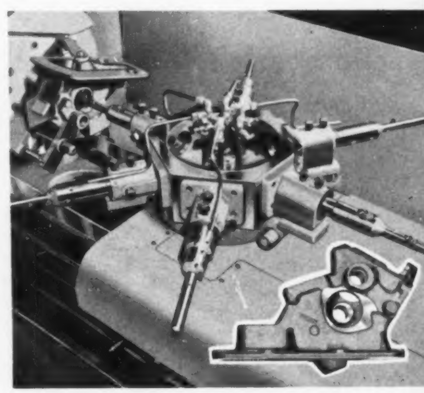
## Fixture on double-tooled automatic turret lathe speeds and simplifies job

How much could you save on your odd-shaped parts requiring special holding fixtures if you used automatic cycle machining?

This setup on a Gisholt 2F Fastermatic Automatic Chucking Turret Lathe which is cutting time 25% on a tough boring operation may give you some ideas. It is used by a large automotive parts manufacturer to machine cast iron tractor steering gear housings. Work quality and tool life have been improved and automatic cycle permits the operator to handle a second Fastermatic.

A counterbalanced fixture is used, with a special arbor for center location in two bores, and a dead stop for length location against a milled face. Manually operated clamps hold the work. Piloted boring bars on hex turret stations 1, 2 and 3 rough, semi-finish, finish-bore and chamfer a 2¾"-diameter bore at the front and a 1¼"-diameter bore at the back. The back bore is also shave-faced. Micro-bore tools, used on hex 3, are so arranged that the front bore is completed just as the lead tool begins to finish the back bore. Rigid piloted tooling, plus separate finishing cuts, minimizes deflection and permits holding a .0005" tolerance in the back bore. Time f.t.f., only 3.5 minutes.

A duplicate set of tools on hex turret stations 4, 5 and 6 permits finishing two parts with each complete index of the hex turret. No time is lost indexing past idle stations and twice the usual number of parts is finished between tool changes.



Special fixture speeds handling of odd-shaped cast iron tractor steering gear housing shown. Piloted finish-boring tools machine front and back bores separately to hold .0005" tolerance in back bore.

***Special fixture speeds work-handling. Double-tooled hex turret minimizes nonproductive time. Automatic cycle permits operator to handle second Fastermatic.***

No. 3-459
730

The Gisholt Round Table represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

Printed in U.S.A.

**GISHOLT MACHINE COMPANY** Madison 10, Wisconsin

**Turret Lathes • Automatic Lathes • Balancers • Superfinishers • Threading Machines • Packaging Machines • Masterglas Molded Plastic Products**

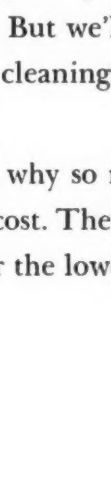
*50 years of results that satisfy just about everybody... except Oakite.* And we never will be satisfied. Our goal has always been to furnish even *better* cleaning at even *lower* cost—AND IT ALWAYS WILL BE!

Sure we're proud of the hundreds of Oakite "firsts" in developing fine cleaning compounds, cost-cutting methods, time-saving mechanical equipment. But we'll never rest on pride. As soon as we find a satisfactory answer to a cleaning problem—our research starts searching for an even better one.

That's why so many users continue to rely on Oakite to reduce their "per unit" cost. They know that year after year, they are getting the best cleaning for the lowest possible cost.

OAKITE

50 1909-1959 SCIENCE *years' leadership in industrial cleaning*

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This handy guide is a distillation of 50 years of Oakite cleaning experience. It can save you valuable time—and cold cash, too—on all your cleaning operations. Send for it. Oakite Products Inc., 26 Rector Street, New York 6, N. Y.

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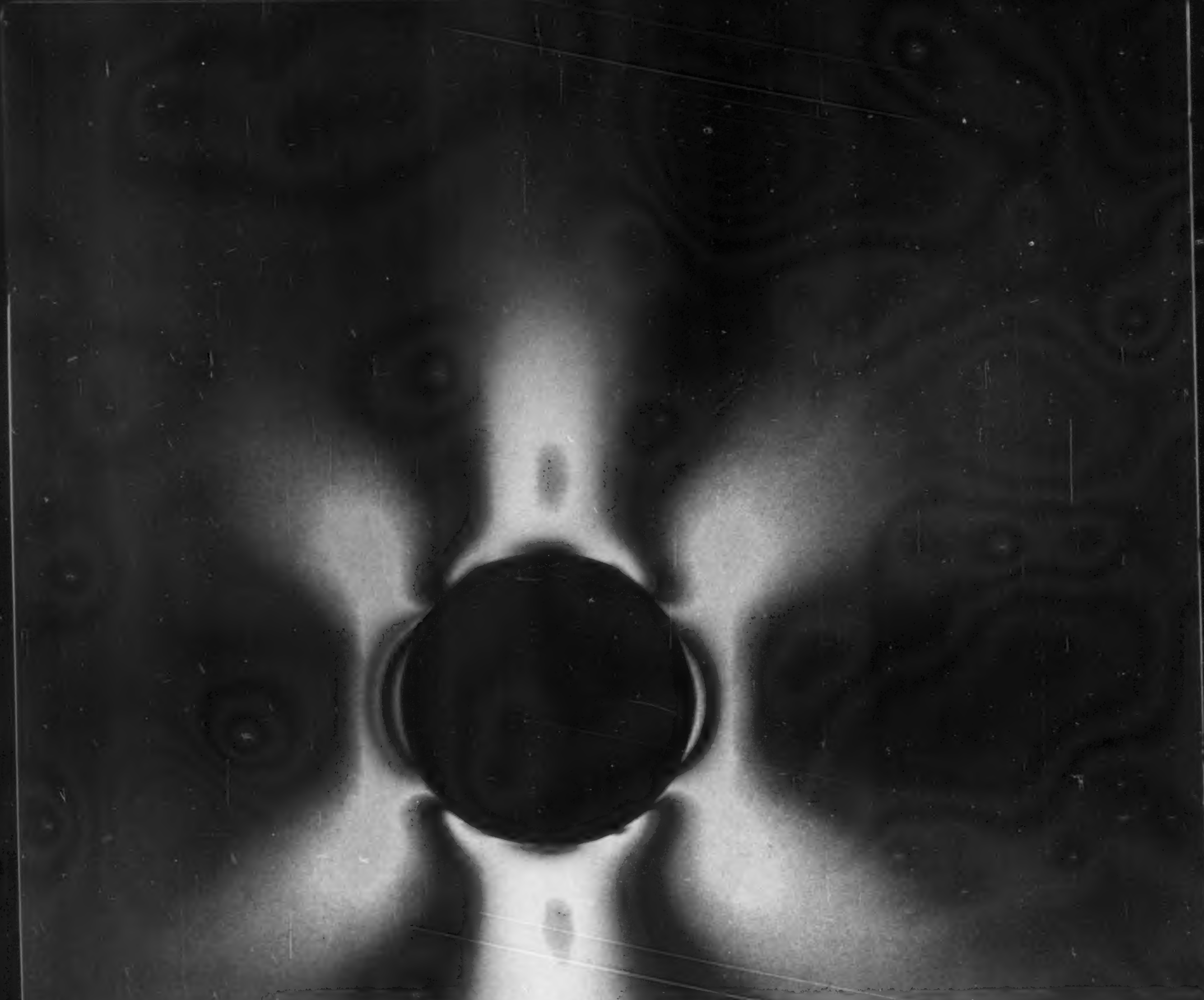

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# How Machinability of Malleable Castings Increases Strength Per Dollar

In manufacturing metal parts, two questions always arise; "Will the material do the job?" and "How much will it cost?" With tensile strengths from 50,000 p. s. i. to 120,000 p. s. i. available in modern Malleable irons, plus extraordinary toughness, ductility and machinability, Malleable castings are uniquely qualified to "do the job."

But more important in today's competitive market is "How much will it cost?" Here, machining plays a very important part. First, many machining operations are eliminated, because with castings the metal is placed only where it is needed. Second, Malleable is the most machinable of all ferrous metals of similar hardness, so every machining operation is done faster with less tool and power consumption. The money saved by Malleable's greater machinability cuts finished costs to the point where Malleable provides more strength per dollar than any other metal, ferrous or non-ferrous.

## Example Demonstrates Machining's Importance

The T-bolt shown in Fig. 1 is used to assemble steel channel frames. Small but mighty, these 7/16" bolts hold 4 ton loads. Tensile strength requirements are 90,000 p. s. i. to 100,000 p. s. i. This part requires metal that has good ductility, holds to close tolerances, guarantees uniform properties bolt after bolt and offers production economy.

The T-bolt is a pearlitic Malleable sand casting 1.42" long and 1.12" across. The head, which must slip through the channel opening, is coined to a tolerance of .010" on its .475" width. Coining Malleable is a common and easy operation and, in this case, guarantees tolerances and assures a tight jig fit for the threading operation.

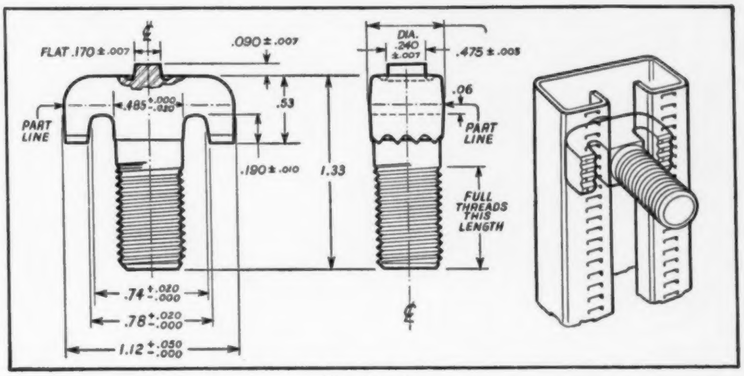


Fig. No. 1

## Close Tolerances Held with Malleable Castings

Two other dimensions are critical. Tolerances on the distance between the teeth and the shank must be held to +.020" and —.000" each side. This assures proper fit in the channel. The protrusion on top of the head must be kept between .233" and .247". Both of these dimensions are met in the as-cast state. Costly machining is completely eliminated.

The T-bolt is threaded on a two place automatic lead screw tapping machine. Using standard chasers and soluble oil, finish 7/16-20-UNF threads are cut at the rate of 1,250 pieces per hour without previous hollow milling. Even though considerable metal is removed at the top of the thread, tool life and power consumption are good.

Attachment of a coil spring to the top of the head is the final operation. This is done by positioning the spring and upsetting the protrusion in a simple staking press operation. This is the operation that requires good ductility. Elongation must be 5 to 6% to permit good upsetting.

Malleable's superior machinability, plus the elimination of many machining operations, produced these parts for one-third less than the previous material.

## Write for Free Data Unit

*Data Unit 102-Strength*, more fully describing Malleable's strength characteristics, is available for use by materials specifiers and users. For your copy, contact any member of the Malleable Castings Council or write to Malleable Castings Council, Union Commerce Building, Cleveland 14, Ohio.


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"This new 50" LeBlond sold for more than $100,000!"
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Technical Equipment Sales Co.
LeBlond Indianapolis Distributors
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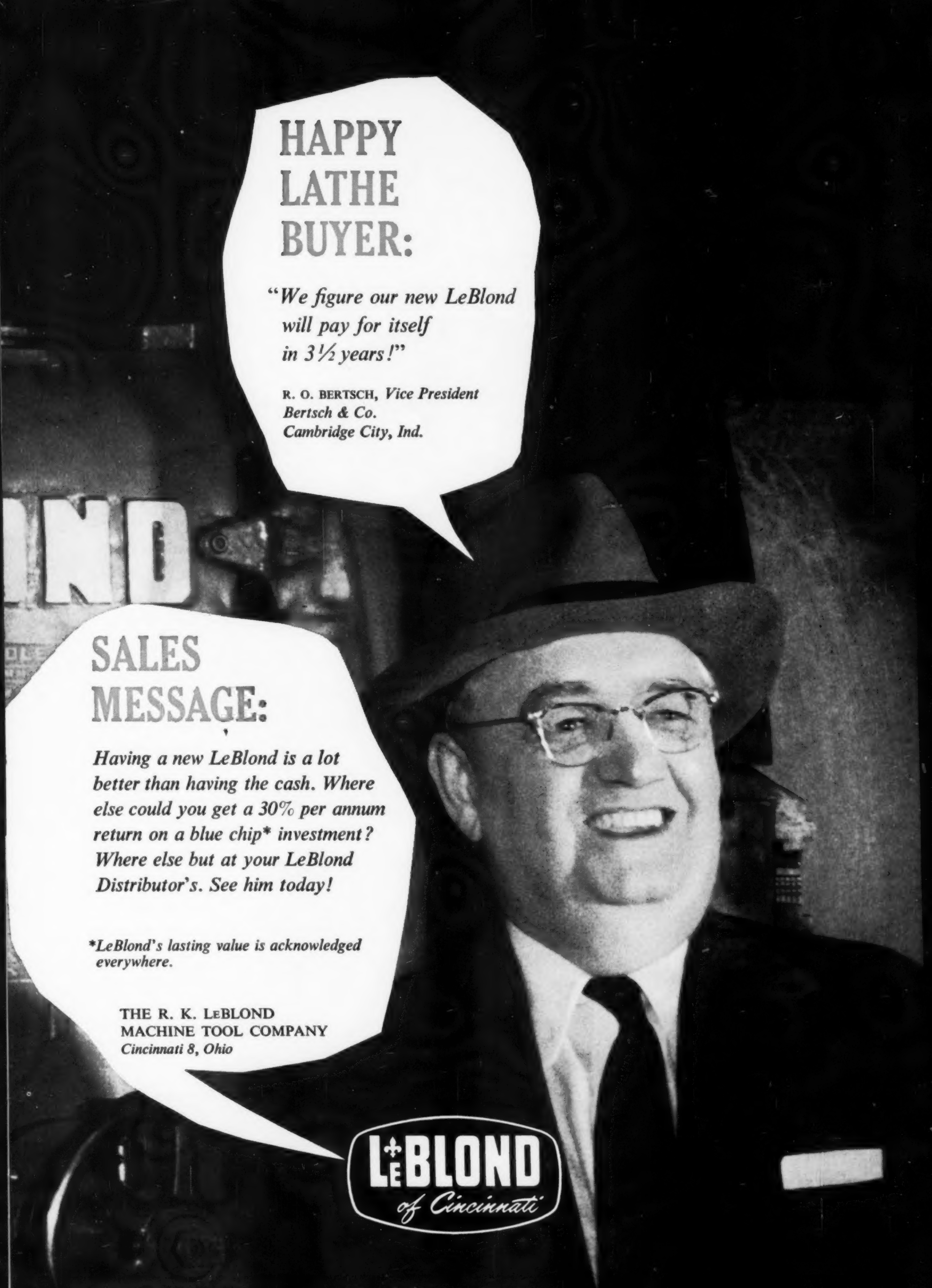
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"We figure our new LeBlond will pay for itself in 3½ years!"
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*LeBlond's lasting value is acknowledged everywhere.
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MACHINE TOOL COMPANY
Cincinnati 8, Ohio
LeBLOND
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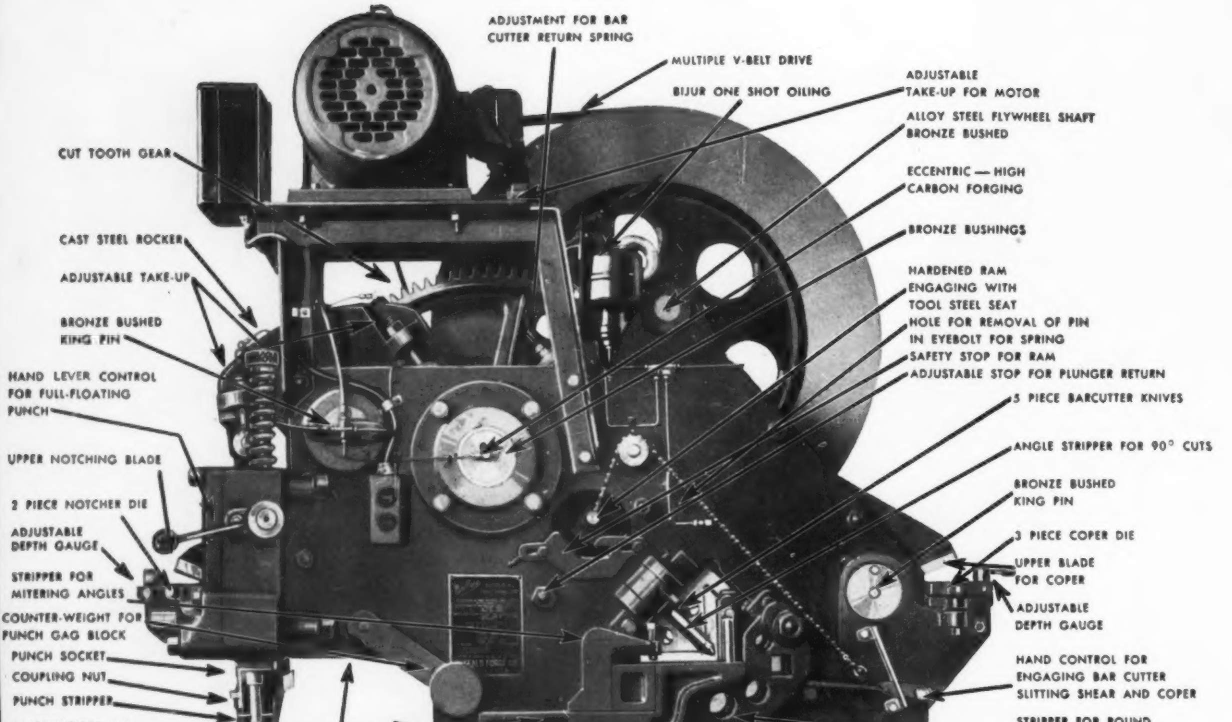


**"BUFFALO" UNIVERSAL IRON WORKER** — These construction details clearly show you why the "Buffalo" Universal Iron Worker does more jobs, does them better, faster, and lasts longer.

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# WITH ONE MACHINE COST AND SPACE!

- **Low Initial Cost of *One* Machine!**
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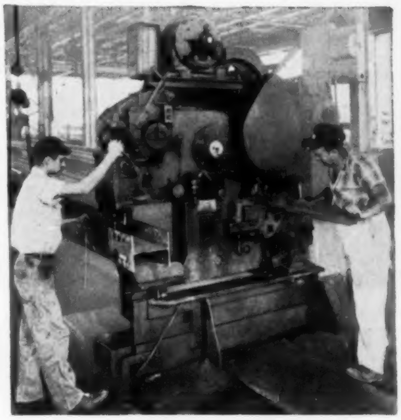
- **Saves Labor, Setup and Production Time!**
- **Saves Productive Floor Space!**

Are you losing valuable time and floor space every day because you have several machines in different locations doing work which could be handled by a "Buffalo" Universal Iron Worker? This sturdy, dependable workhorse cuts, punches, shears, slits, copes, miters and notches at a very high output rate. The UIW quickly and easily handles angles, tees, channels, bars, flats. It's built to take plenty of punishment, too — with welded steel plate box frame, heavy shafts, bearings, bolsters and plungers. Centralized oiling system insures permanent proper lubrication.

See how the "Buffalo" Universal Iron Worker can profitably speed **your** operations. Phone your "Buffalo" machine tool dealer, or write for Bulletin 360-H for range of capacities and details.



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Punching and shearing simultaneously on a "Buffalo" Universal Iron Worker.

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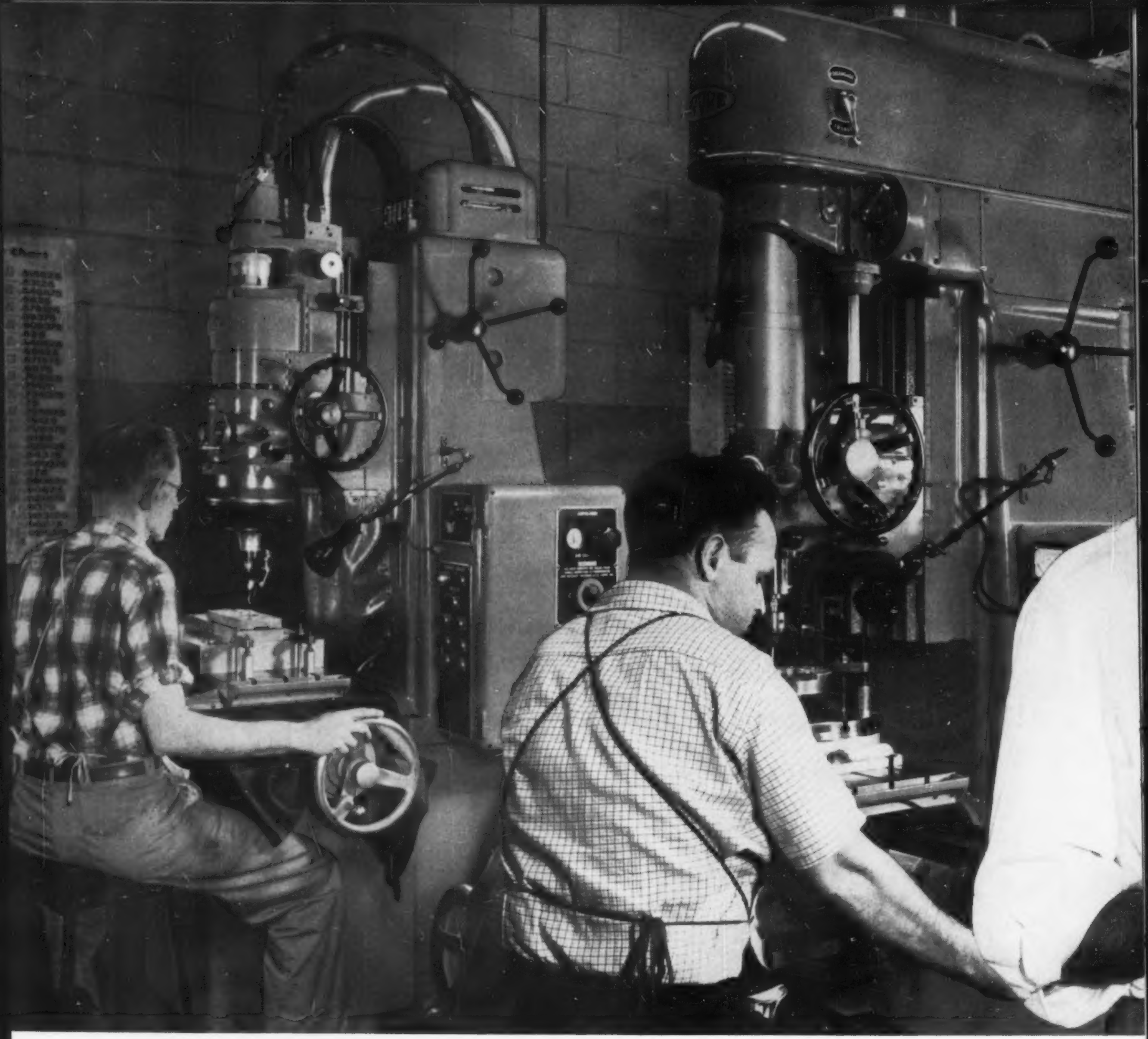


# "We're now splitting tenths, thanks to Moore's

*say Karl Harig, chairman,*
*and Herbert Harig, president*
*of* **Harig Manufacturing Corporation**, *Chicago*

**"Our operators feel these are the best machines they have ever worked on...**

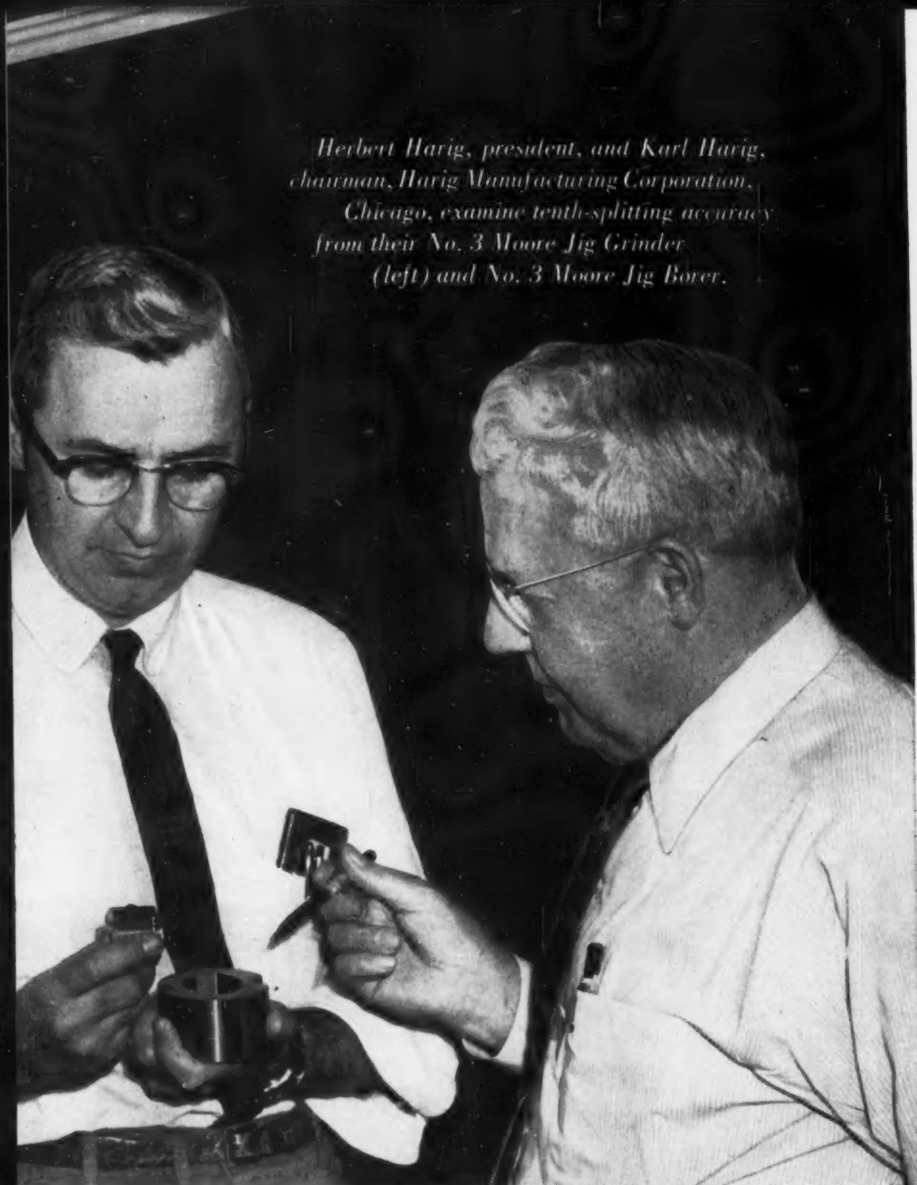
**"Moore's No. 3 Jig Borer and No. 3 Jig Grinder take care of the tenth-splitting tolerances required by industry today..."**

These are the words of two of America's acknowledged tooling leaders, active heads of one of the country's foremost independent producers of accurate dies—carbide, lamination, progressive, and other precision tooling.

Says President Herb Harig, former president of National Tool & Die Manufacturers Association:

"Moore's line of Jig Borers and Jig Grinders has been an integral part of the development and success of our company from 15 employees in 1937 to 120 today. We have always been

MOORE TOOLS **manufactured by**



*Herbert Harig, president, and Karl Harig, chairman, Harig Manufacturing Corporation, Chicago, examine tenth-splitting accuracy from their No. 3 Moore Jig Grinder (left) and No. 3 Moore Jig Borer.*

# new No. 3 Jig Borer and Jig Grinder"

Made and calibrated to the new international inch.

among the first to install each new model. That's why we are among the first with Moore's tenth-splitting No. 3 Jig Borer and No. 3 Jig Grinder.

"As evidence of how indispensable we consider this equipment, over the years we have enlarged our Moore Jig Boring and Jig Grinding Department to 15 machines!"

Sums up Chairman Karl Harig:

"When owner-management invests its money in machinery, it does so only after thorough analysis and careful selection. I don't know of any machine tool manufacturer which meets both tests better than does Moore."

There's little more we can add, except to say that we stand ready to help you duplicate Harig's record of satisfaction. You can start by asking today for our detailed literature on the new No. 3 machines with their larger tables; hardened, ground and lapped ways; no gibs, no overhang.

Also, our dealer organizations will gladly share with you their extensive knowledge of holes, contours and surfaces (see column at right).

**MOORE SPECIAL TOOL COMPANY, INC.**

Bridgeport 7, Connecticut

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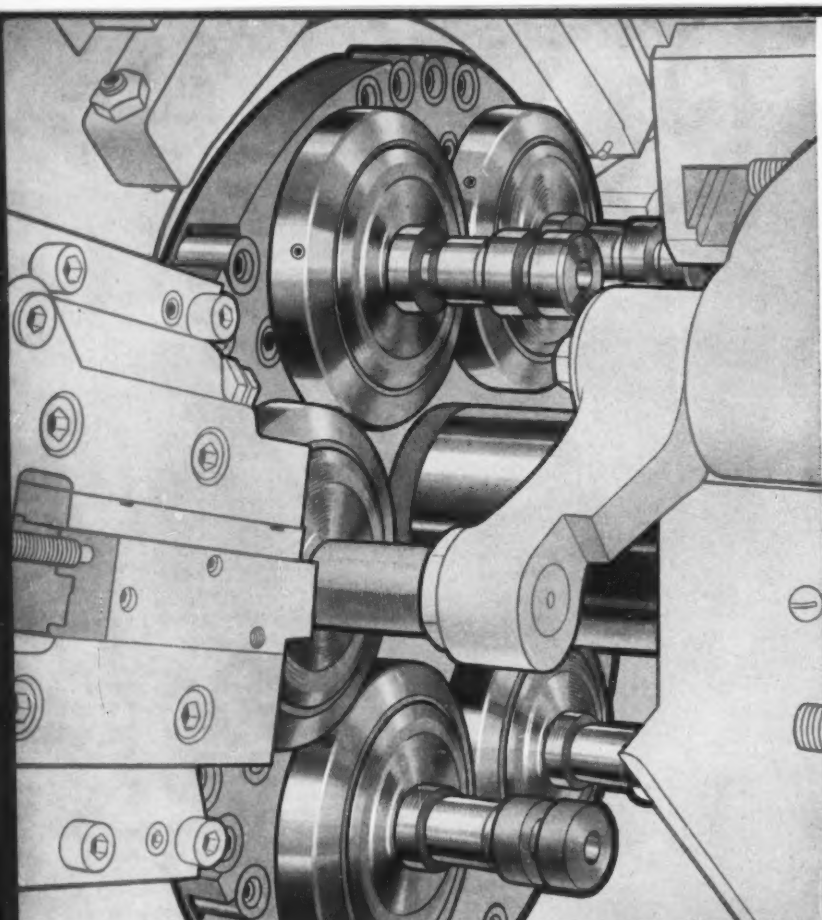
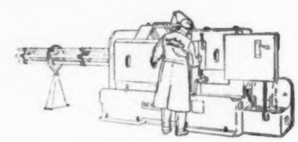
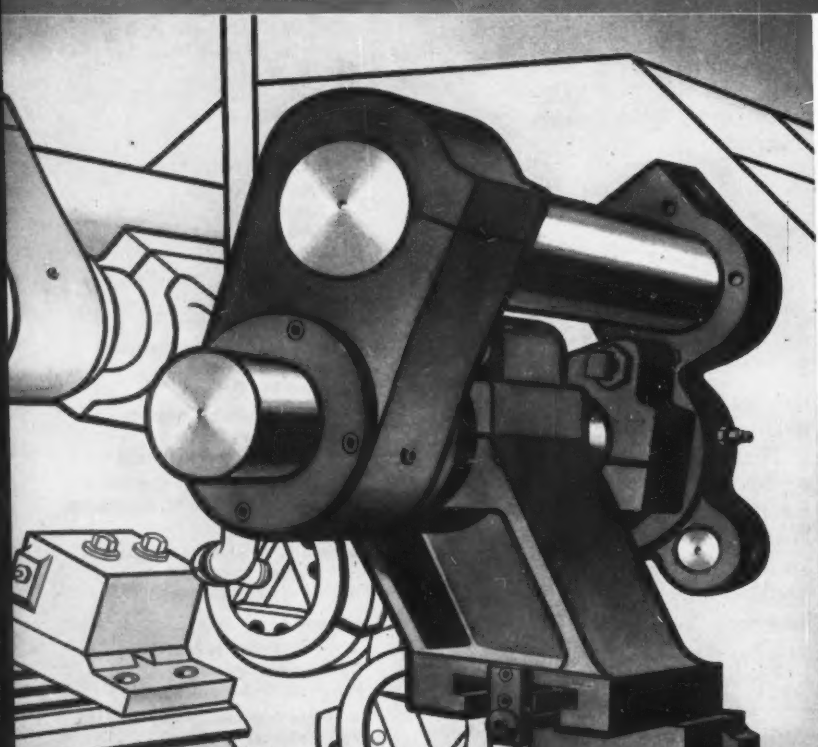




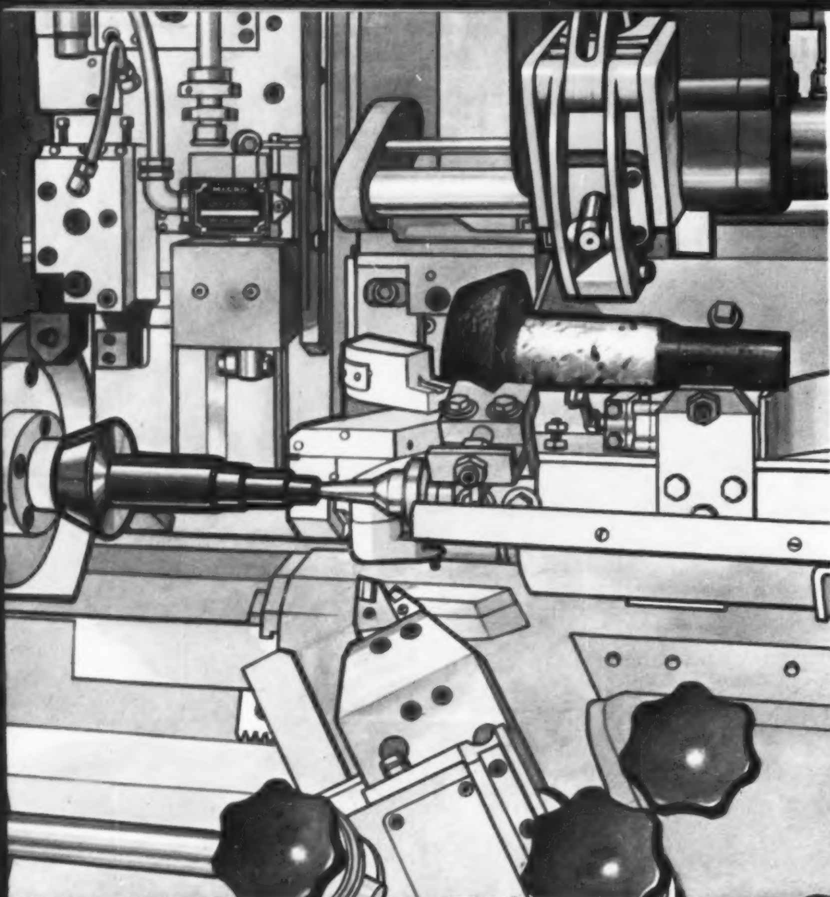




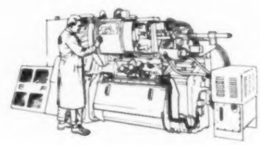




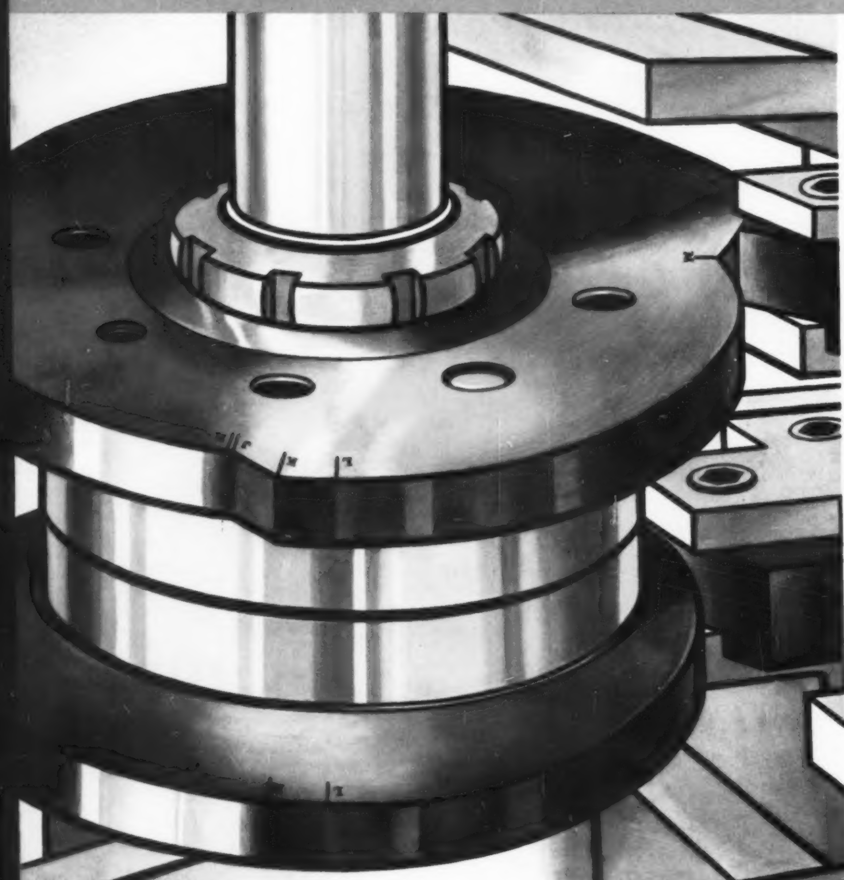




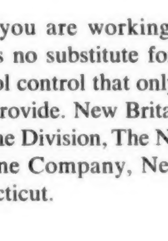
Look at
Automatic Loading on
**New Britain +GF+**



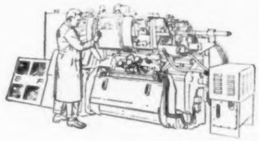
This basic optional feature can make money for you whether you are working with forgings, bar slugs, or bar stock.



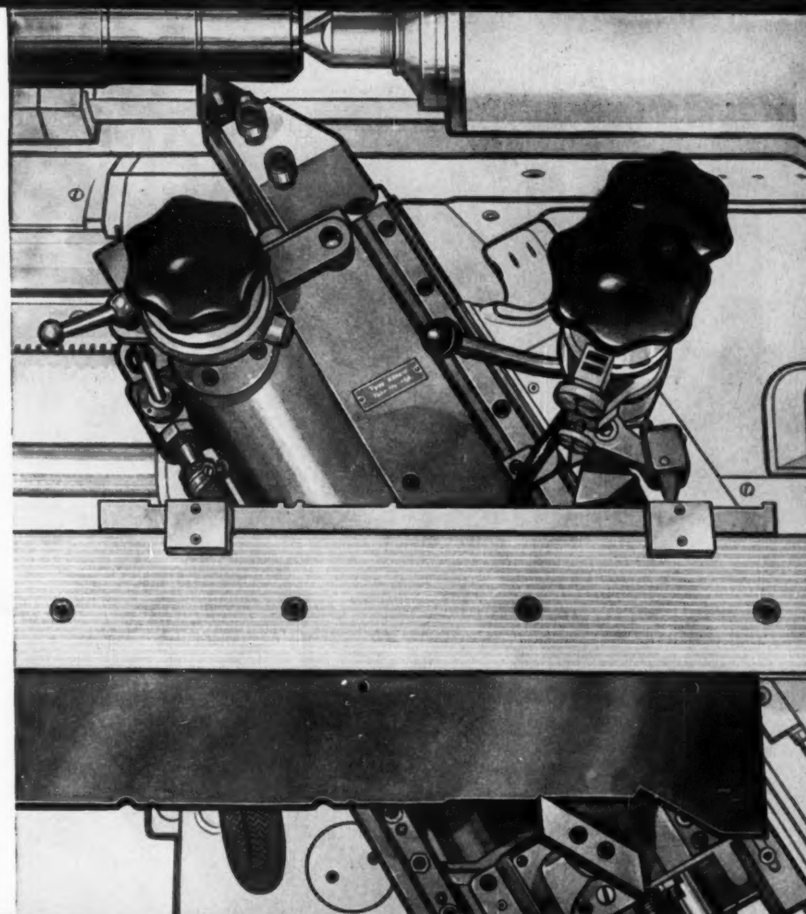
Look at New Britain's
**cam-controlled boring machine**



When you are working to tenths there is no substitute for the positive tool control that only precision cams provide. New Britain-Gridley Machine Division, The New Britain Machine Company, New Britain, Connecticut.

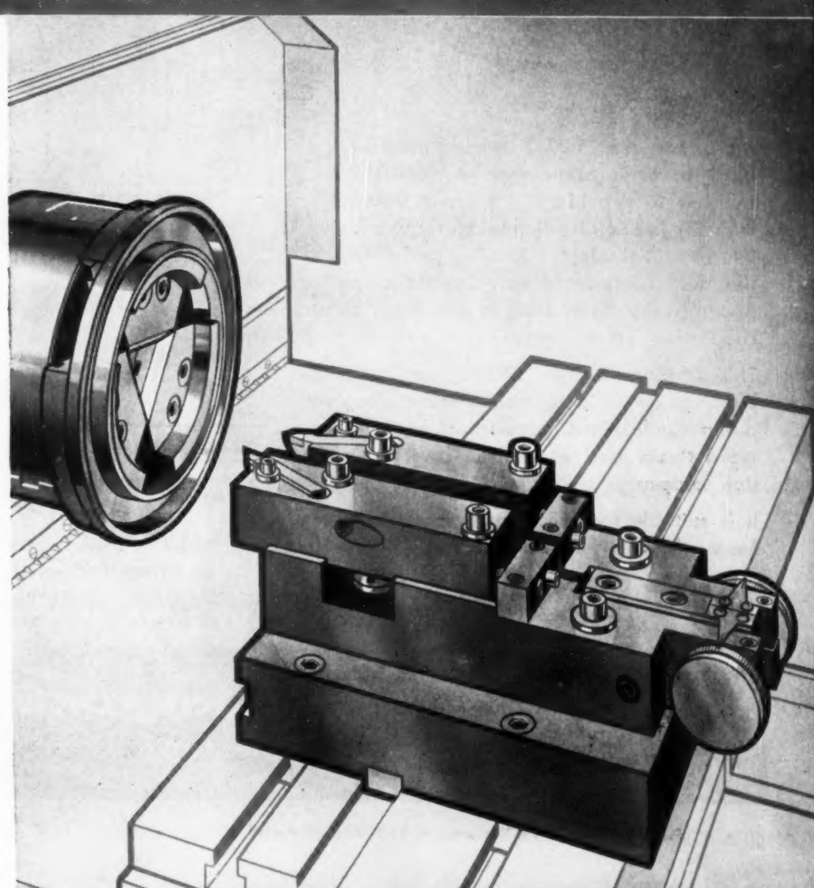


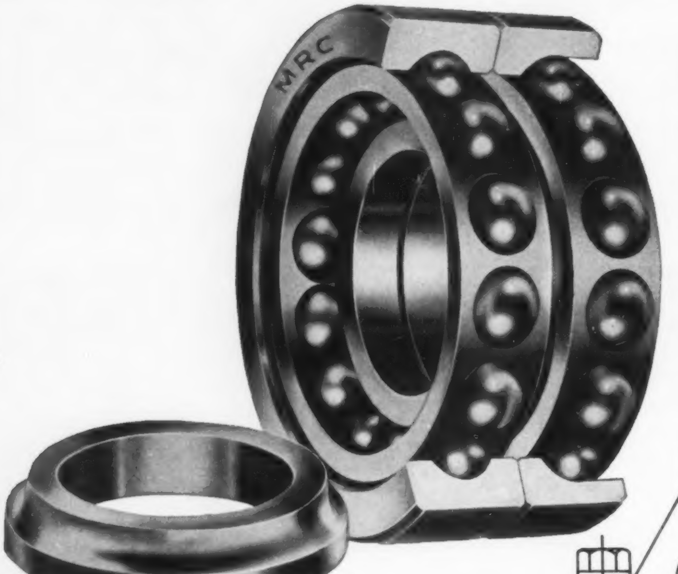








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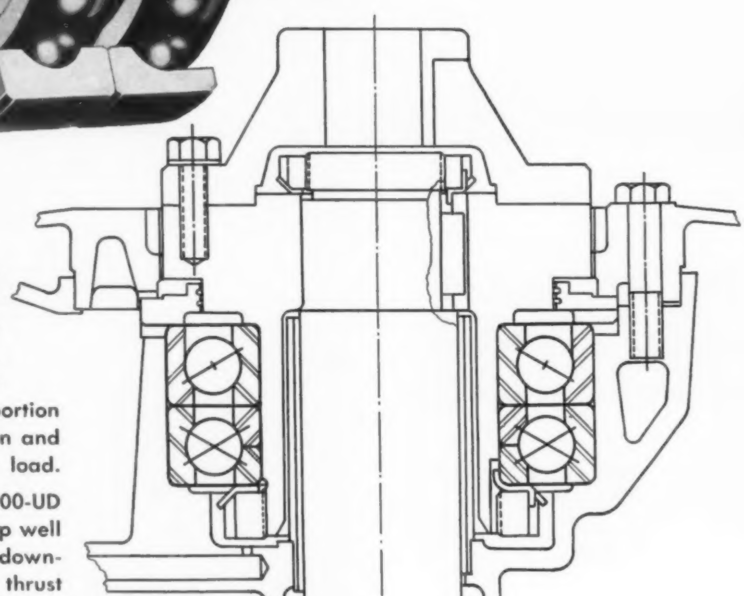


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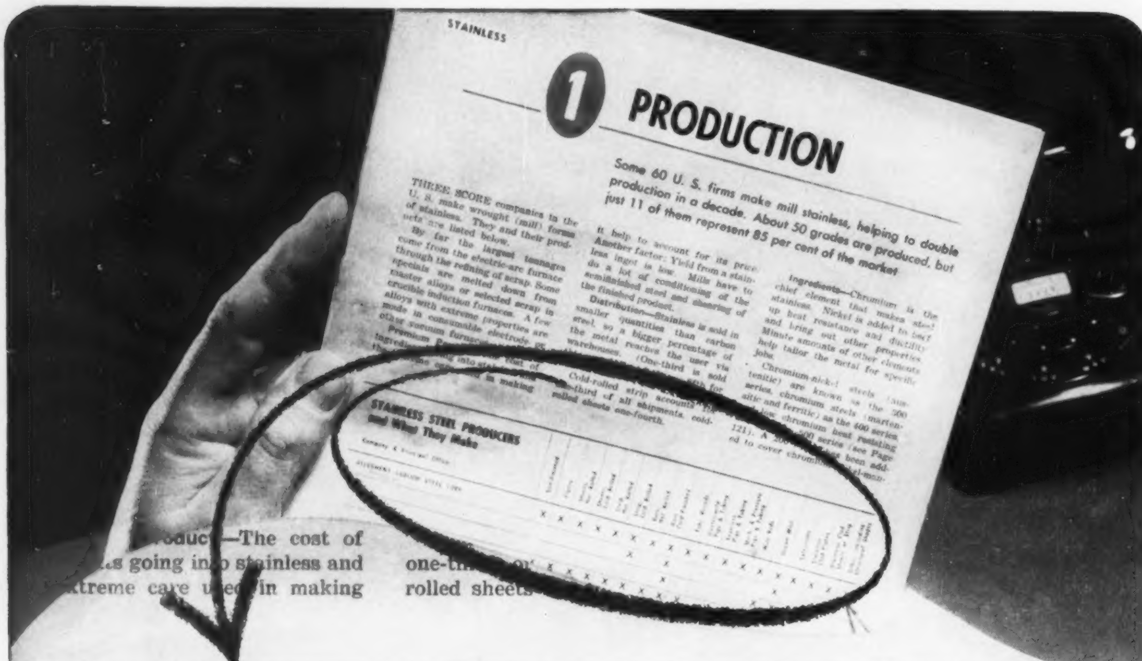


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# Of the 60 producers of stainless steel...

## only ALLEGHENY LUDLUM makes all sizes, shapes, finishes and analyses

In its November 4, 1957 issue, STEEL magazine published a complete run-down on the stainless steel industry. This article reveals that *only Allegheny Ludlum*, of the 60 some companies making stainless, produces all sizes, shapes, finishes and analyses.

This can save you considerable time and money. When you make Allegheny Ludlum your *one* source of stainless, you work with *one* sales engineer—*one* order, whether you buy sheet, strip, bars, tubing or whatever.

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Allegheny Ludlum follows the product from the melt through to finished form, has greater quality control over the stainless you buy. And since A-L makes all forms of stainless, you get unbiased recommendations as to what is best for your individual needs.

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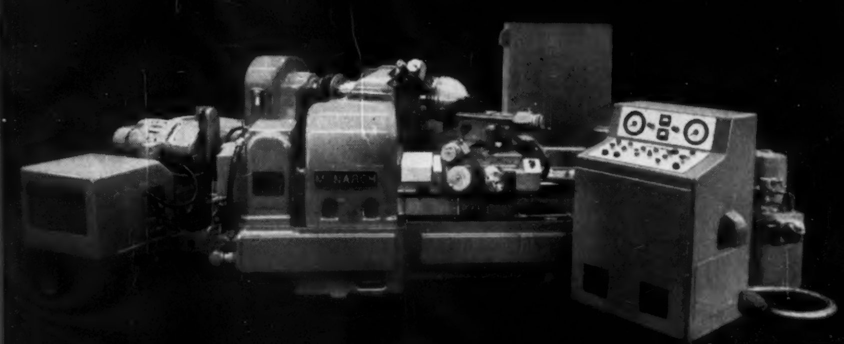
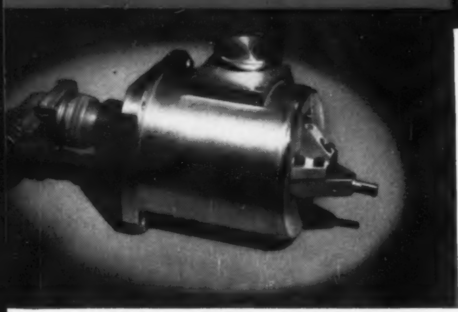
# Don't Tool Up for Tomorrow's Boom with Yesterday's Lathes

## MONARCH'S SPECIAL-PURPOSE LATHES OF TOMORROW...





*The Series 180 tracer head—an advanced engineering jewel from the Development Laboratories of Monarch.*

## 2..The Series 180 Ultra-Precision Contouring Lathe

Ultra-precision tolerances are brought to a new degree of perfection on this chucking type machine for contouring the O.D. and I.D. of thin-wall spherical and related shape work pieces. From the floor up the Series 180 is new in concept. For example:

**1** The Monarch electro-hydraulic tracer has a stylus deflection pressure of only 1½ ounces. This, plus electrical amplification of stylus movement, instantly translates template contour change into hydraulic slide movement.

**2** Tracing around a template, the contour is reproduced at the tool within a total accumulated error of ±75 millionths.

**3** The constant surface cutting speed drive is separately mounted to eliminate vibration transmittal to the bed.

**4** Drive is flexibly coupled to the spindle which is set at a 30° angle to the bed axis. Runout at the spindle nose is less than 20 millionths.

**5** Spindle bearing lubricant is refrigerated; the floor-mounted tracer hydraulic tank is separately cooled and coolant temperature is controlled within ±.5°.

**6** The machine is built and tested in a temperature controlled area and must be so operated.

The performance characteristics of the Series 180 cannot be equalled by any other lathe. Development of this machine is but another example of the many seemingly impossible turning problems solved by . . . *The Monarch Machine Tool Company*, Sidney, Ohio.

**Monarch**
TURNING MACHINES

IF IT CAN BE TURNED, THERE'S A MONARCH TO DO IT BETTER AND FASTER



For more data, circle this page number on inquiry card

# This valve gets a leak-proof seal from a Blanchard Surface Grinder

"The Blanchard Surface Grinder is one of the most important improvements in our modernization program." This report comes from the Commercial Refrigeration Division of Bendix-Westinghouse Automotive Air Brake Company – makers of power and condensing units for refrigeration equipment.

The Blanchard No. 18 Surface Grinder puts a surface of 5 micro inches or better on Bendix-Westinghouse valves at the rate of 75 pieces an hour.

A Blanchard Model 18 Surface Grinder is used to finish grind valve plates used in Bendix-Westinghouse electric refrigeration compressors. They say: "This operation is very important, because – with a surface finish of five micro inches or better – we get a perfect seal on our gaskets and valves, eliminating the possibility of leakage."

Is there room for improvement in *your* surface grinding? For best results . . .

**PUT IT ON THE BLANCHARD**

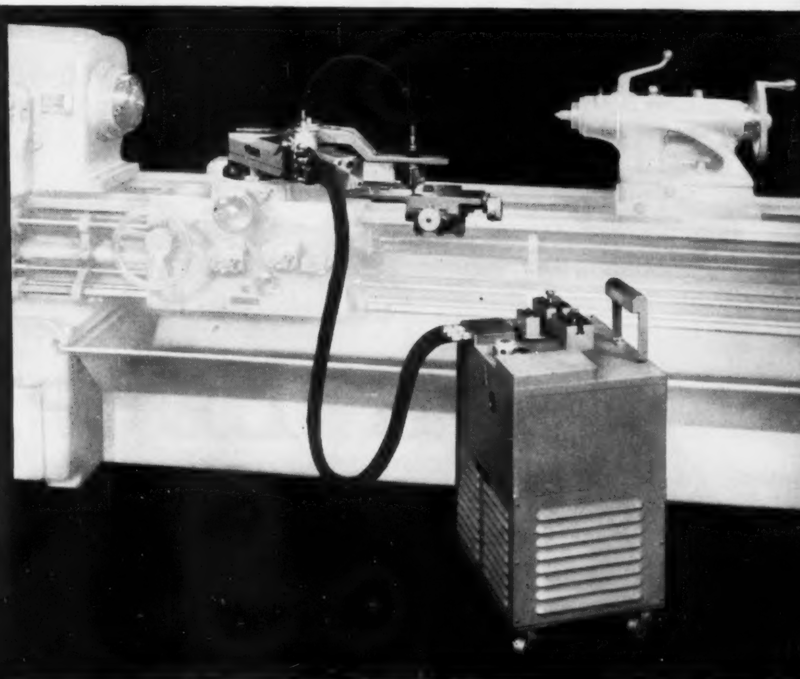
*Write today for your free copy of "Work done on the Blanchard," fifth edition, and "The Art of Blanchard Surface Grinding," fourth edition.*

## THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U. S. A.

# Don't Tool Up for Tomorrow's Boom with Yesterday's Lathes

## MONARCH HIGH PRODUCTION LATHES OF TOMORROW



## 3..The New Air-Tracer Pak... Portable Unit for Standard Monarchs in Your Plant

Here's a real turning technique breakthrough! The Air-Tracer Pak is just what the name implies—a portable, easily applied device for temporarily or permanently adding to many standard Monarchs in your shop *all the advantages of Air-Gage Tracer production.*

And what are those advantages? In a nutshell, this, the most accurate duplicating method in general use, always outproduces manual operation up to 8 to 10 times. It sizes automatically and, using only a single running tool, is ideal for *small lot repetitive work* without the need for expensive form tools or multiple tool setups.

Its accuracy of $\pm$ .001" on most work often cuts in half the stock left for grinding; sometimes eliminates grinding and polishing. It allows complete setup change in as little as 15 to 20 minutes and tool change in 1 minute. It is also the simplest, most trouble-free of all lathe duplicating units.

The photos show how the tracer slide assembly quickly replaces the regular compound rest on the cross slide. Note the template support and micrometer dials—the portable, completely self-contained power unit at the front of machine with air supply and electrical connections in the base.

Presto! it's on. And presto! it's off. Yet it's an adaptation of the time-tested swiveling Air-Gage Tracer with the versatility to handle the more complex turning, boring and facing jobs.

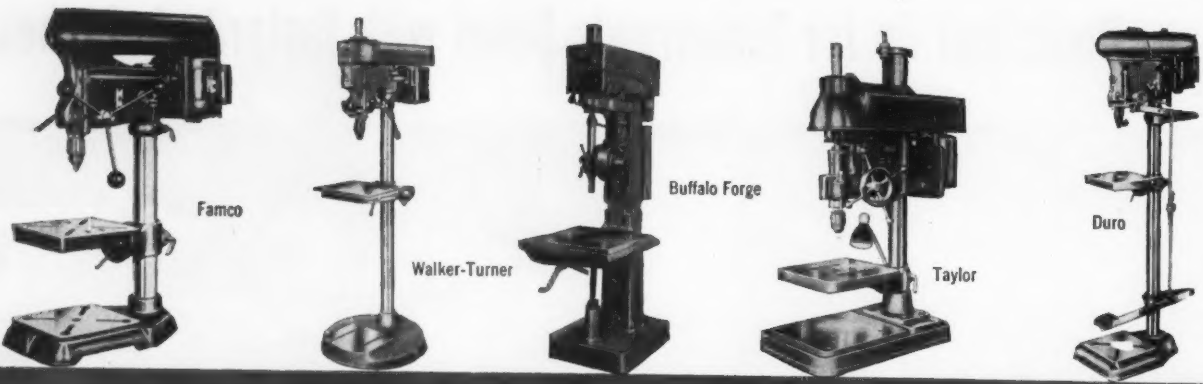
This is news! Write—or phone today—for the full story... The Monarch Machine Tool Company, Sidney, Ohio.

**Monarch**
ACCURACY • ECONOMY • LONG LIFE
TURNING MACHINES

IF IT CAN BE TURNED, THERE'S A MONARCH TO DO IT BETTER AND FASTER

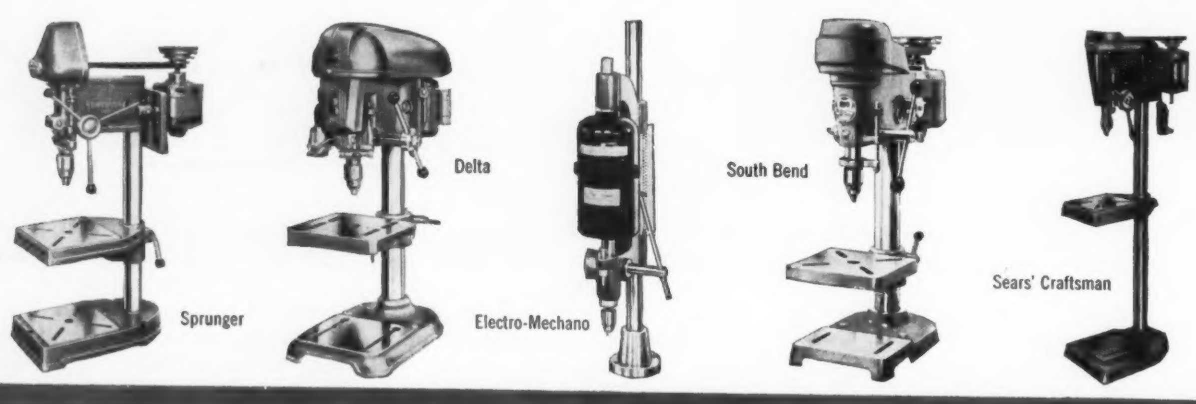


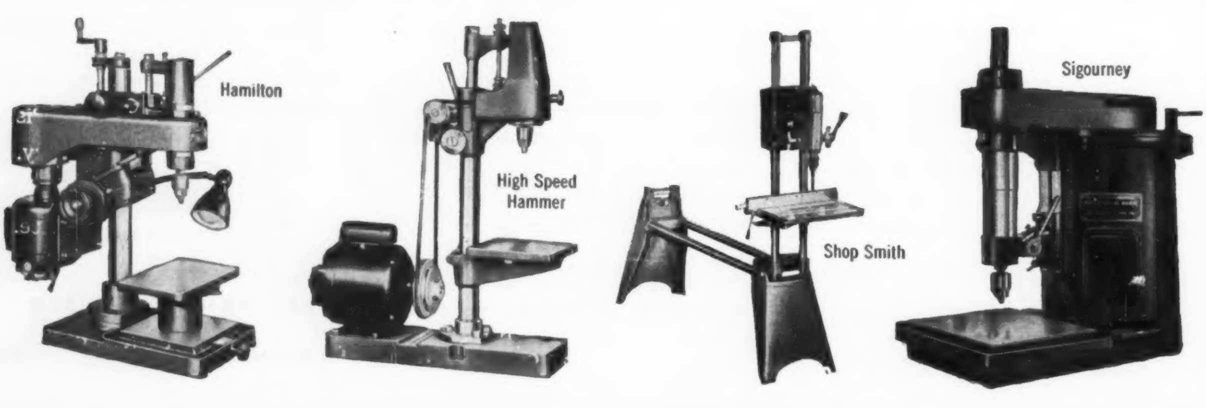
For more data, circle this page number on inquiry card

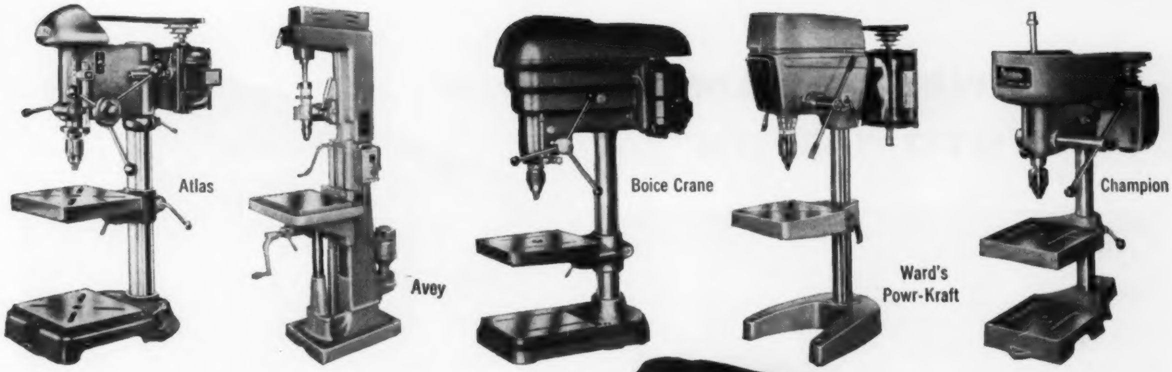



# DRILL PRESS MANUFACTURERS

## *put their money on*

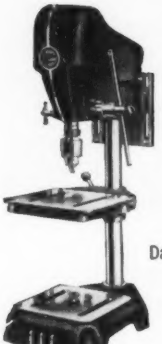





# Jacobs

## CHUCKS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SERVING INDUSTRY ECONOMICALLY
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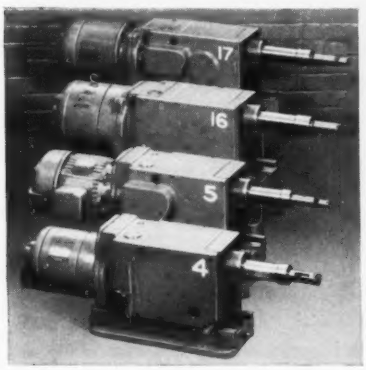
**THE JACOBS MANUFACTURING COMPANY, WEST HARTFORD, CONNECTICUT**

# New Automatic Units with Cam Feeds and Long Strokes

Four new Kingsbury automatic self-contained units combine all these features for better production drilling and tapping —

- Strokes of 4 or 5 inches
- Cam feeds for accurate repetition of the work cycle every time
- Positive drive with friction safety clutch
- Continuous flow of oil from a rotary pump
- Interchangeable air or electric controls
- Mounting in almost any position
- May be converted for either drilling or tapping operations




**Quills are fully extended to show available strokes —**
**4 inches on models 4 and 5,**
**5 inches on models 16 and 17.**

## Fully Tested and Guaranteed

These new developments result from 35 years of experience in building automatic drilling and tapping units. They stand up well under rugged production demands. Work cycles are always the same for uniform product. Operation is reliable. Here at Kingsbury our shop men praise them, and that is rather an acid test.

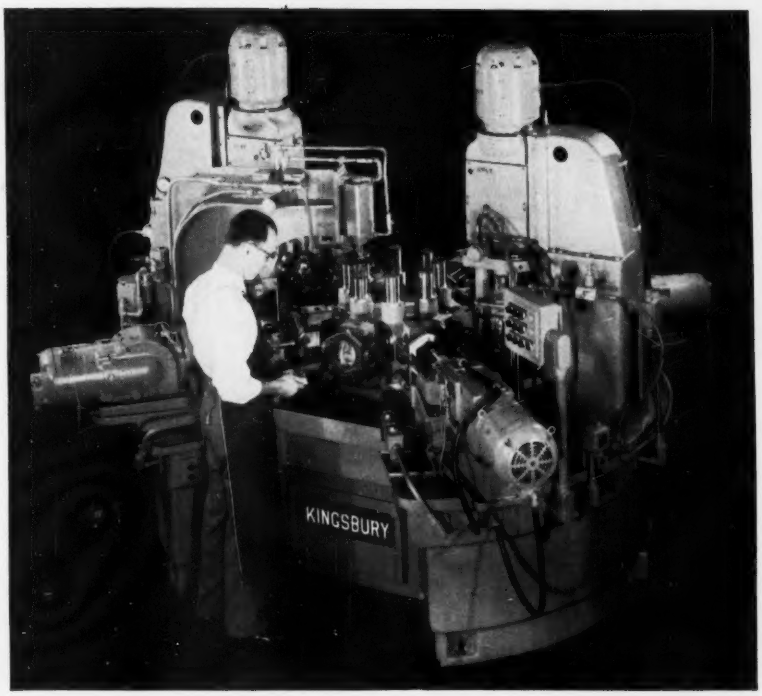
**Horsepower and Spindle Speeds**

| MODEL | HP | SPINDLE RPM |
|---|---|---|
| 4 driller | 1/2 | 750 — 4100 |
| | 1 | 1500 — 8200 |
| 5 tapper | 3/4 | 465 — 1415 |
| 16 driller | 1 1/2 | 596 — 3500 |
| 17 tapper | 1 | 368 — 2160 |

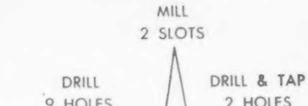
**Capacities**

| MODEL | CAST IRON | FORGED STEEL |
|---|---|---|
| 4 driller | 3/8 | 3/16 |
| 5 tapper | 3/8-16 | 5/16-18 |
| 16 driller | 3/4 | 1/2 |
| 17 tapper | 5/8-11 | 1/2-20 |

**Kingsbury Machine Tool Corp., Keene, N. H.**




# 22-spindle Kingsbury mills 2 slots, drills 18 holes, taps




*DIE CAST ALUMINUM FLAT IRON SOLE PLATE*

Five horizontal and two vertical units operate 22 tools. The vertical units mill the slots with six-inch cutters. Each cutter rotates so the thrust is down. The slots, incidentally, make it easier to iron around buttons.

Four horizontal units drill 11 holes and combination drill and countersink 7 holes. Bushings guide these tools. The last unit taps two of the holes.

A 30-inch index table holds eight work fixtures. Each has power clamping and automatic unclamping through use of an air cylinder. The point of the work is up, and clamping is outward against a fixed front plate. Gross production is 520 parts per hour.

Production men praise our machines. "Can't remember when we had trouble with them."

"Our Kingsburys do a nice job for us."

"Hardly ever get a bad part."

We think we earn those compliments. Forty years behind us and we still work hard on every machine we build. Good basic design, rugged construction, test runs before shipment — all that sort of thing really pays off.

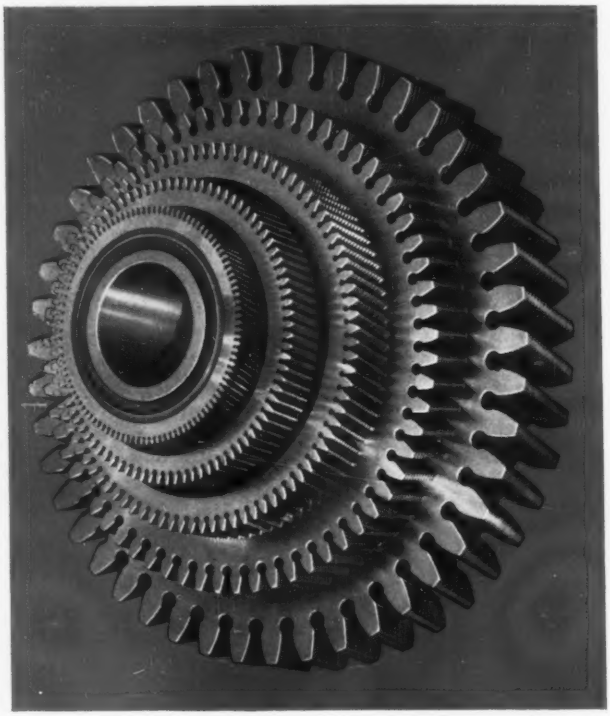
For high production at low unit cost, ask to have a representative call and talk over your jobs. Let him get you a specific proposal. If we say we can do it, we can do it. Kingsbury Machine Tool Corp., Keene, N. H.

**KINGSBURY** MULTI-UNIT AUTOMATICS



For more data, circle this page number on inquiry card

# WHY RED RING GEAR SHAVING CUTTERS DO SUCH AN EXCEPTIONAL JOB



- Here are some of the reasons for the accuracy, for the job performance and the long economical service life of Red Ring Shaving Cutters.
- These cutters are engineered and produced by skilled specialists who have, for the past 27 years, devoted full time to shaving cutters, exclusively. Never underestimate this vast fund of experience which is unmatched anywhere else in the field.
- All Red Ring cutter grinding and cutter inspections are carried on in temperature controlled departments, for maximum precision. Where else is this done?
- Every Red Ring Cutter is made from a controlled specification forging—proper grain flow and uniform distribution of carbides in the tooth zone.
- Every Red Ring Cutter is heat treated in Red Ring furnaces under the direct control of Red Ring metallurgists.
- Every new cutter design is given a thorough performance try out in the Red Ring Gear Laboratory before it is released.
- Red Ring cutter engineers and service specialists are always available for consultation and to help a cutter customer in an emergency.

When you buy cutters, take advantage of these extra benefits. There is no extra cost.

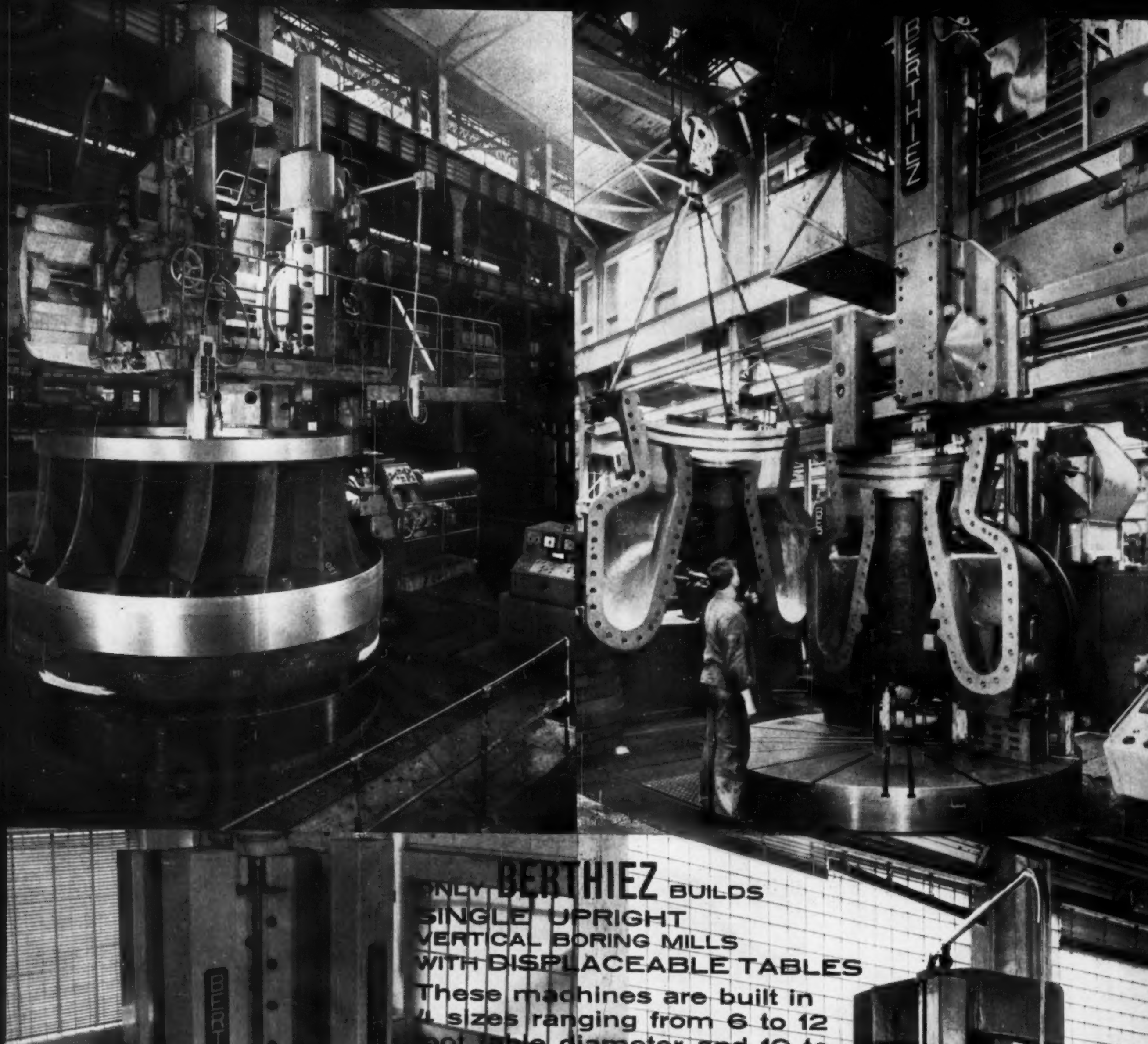
8263

SPUR AND HELICAL GEAR SPECIALISTS
ORIGINATORS OF ROTARY SHAVING,
GEAR HONING AND ELLIPTOID

**NATIONAL BROACH & MACHINE CO.**

5600 ST. JEAN • DETROIT 13, MICHIGAN

*WORLD'S LARGEST PRODUCER OF GEAR SHAVING EQUIPMENT*


BERTHIEZ
ONLY BERTHIEZ BUILDS
SINGLE UPRIGHT
VERTICAL BORING MILLS
WITH DISPLACEABLE TABLES
These machines are built in
4 sizes ranging from 6 to 12
foot table diameter and 10 to
22 feet diameter to be turned
S. A. DES ANC TS CHARLES BERTHIEZ, 5, RUE MONTALIVET, PARIS

# olivetti

*high-precision grinding machines with hydraulic automatic infeed for traverse grinding and plunge grinding as standard equipment on all models.*

*3 types:*

**UNIVERSAL.** *Swivelling wheelhead, swing-down internal grinding attachment, infinitely variable speed headstock.*

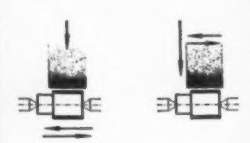
**PRODUCTION.** *Larger grinding wheel, more horsepower, non-swivelling wheelhead, 8-speed headstock.*

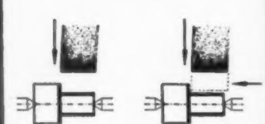
**PLUNGE.** *Similar to production type but with axially oscillating wheelhead and hand table control only.*

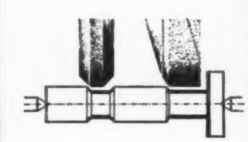
*4 sizes:*

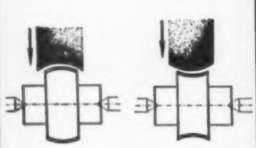
*10", 12", 14", and 18" swings (with choice of lengths between centers).*

*Model R4-500 U shown at left. Universal type, 10" swing, 24" center distance.*





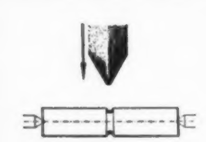


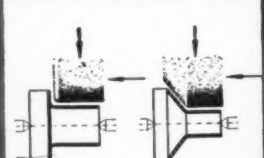


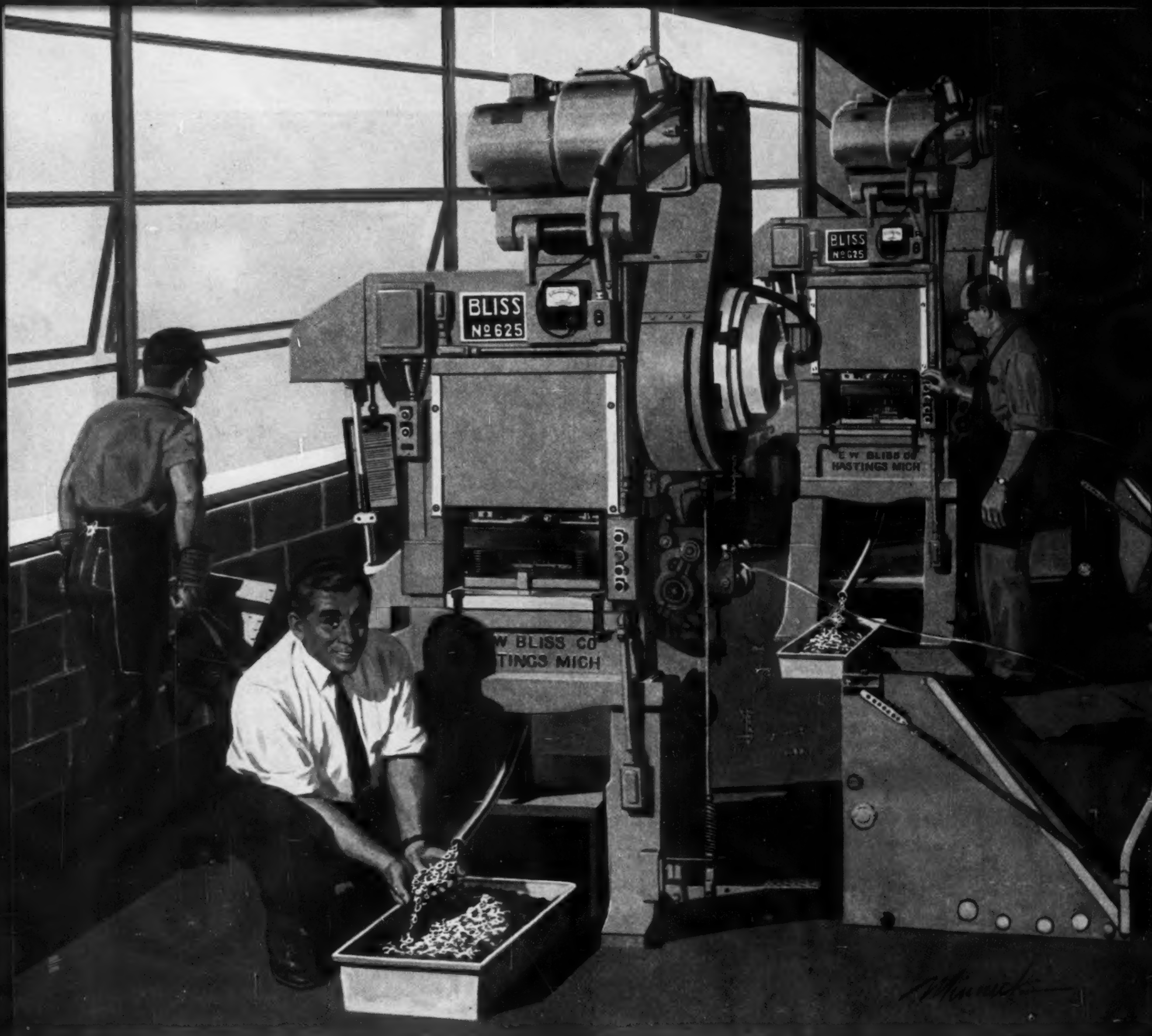
## SOME STANDARD FEATURES OF OLIVETTI R4 UNIVERSAL GRINDERS:

- *Infinitely variable hydraulically controlled table speeds*
- *Table reversals within ± .0002" as short as 1/16"*
- *Table dwell 0 to 20 seconds*
- *Automatic precision infeed to .000050", right, left or both ends of traverse*
- *Thumb jog for taking .0001" cuts on diameter*
- *Separate automatic plunge feed 0 to .002"/second to positive stop*

*For sales, service or information, write Olivetti Corporation of America, Machine Tool Division, 42-33 Northern Boulevard, Long Island City 1, New York. Or phone RAvenswood 1-7575.*



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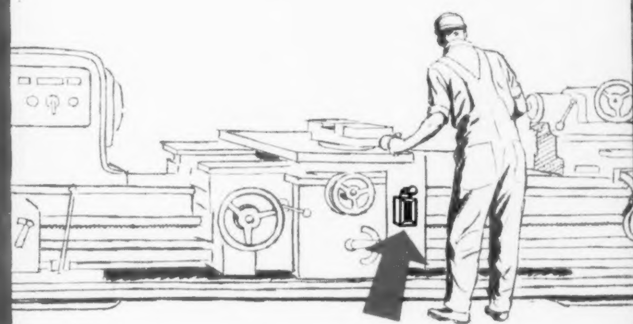
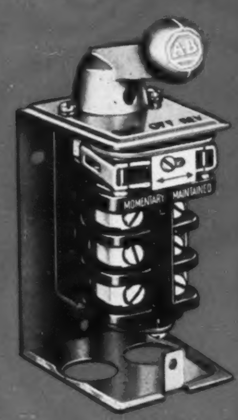
# ALLEN-BRADLEY

# REVERSING DRUM SWITCHES

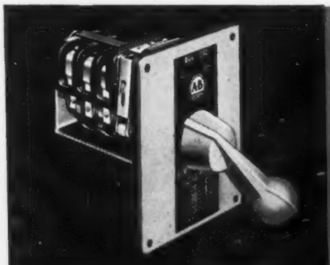


**BULLETIN 350**
Style A wrap-around cover is removed to show the readily accessible front wiring terminals. Max rating: 2 hp.

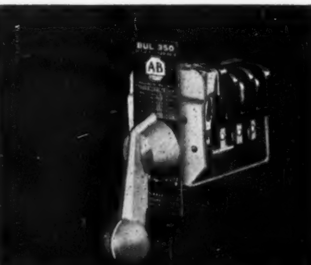
## ...styled to match the most modern production machines!

Inside and out—this Allen-Bradley drum switch is *all* new. Its trim, modern lines and attractive die-cast aluminum handle will give your production machines "up-to-the-minute" styling.

But there is more than beauty to this new switch. The rugged switch mechanism is a self-contained unit—independent of the enclosure. Misalignment and binding *cannot* occur. The base mounts directly on machine surfaces—without using spacers. And with the wrap-around cover removed, terminal screws are exposed for fast wiring—from the front. Changeover from momentary to maintained contact operation can be made in seconds. Investigate this new "leader" in its field. Send for Publication 6091.



**OILTIGHT CAVITY MOUNTING**
A-B Style AF reversing switches can be furnished with sealed shaft and rubber-gasketed, oiltight cover for cavity mounting in a machine base.




**PANEL MOUNTING**
The new Style A switches can be furnished for mounting directly on panels. Nameplate which gives ratings is also included with each switch.

# ALLEN-BRADLEY

**Quality Motor Control**

Allen-Bradley Co., 1316 S. Second St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

3-59-MR



## in our specialized industry, a sound program of machinery replacement is a first requirement...

"In the highly specialized field of Diesel engine production, the highest quality and most productive machine equipment is an absolute necessity.

"Cummins Engine Company, Inc. continuously searches for better tools and more modern equipment that will increase production and the efficiency of plant operations. We regard it as wasteful to have obsolete machines in our plant and we replace our equipment as soon as newer and better machines become available.

"In pursuing this program, our Industrial Engineering Department actively solicits the assistance of supervisors and foremen to determine what equipment might be replaced to improve quality of product and reduce production costs. This system of encouraging our production people to make contributions has been a vital factor in keeping our plant up-to-date. It is one of the reasons the average age of machines used in production of Cummins Diesel Engines is *less than five years old.*

"We keep maintenance records on each piece of Cummins equipment. These records show price, year, labor and parts costs, serial number and model of the equipment. This kind of accurate record keeping serves as a practical guide in determining whether a machine or a tool is really doing its job efficiently and well.

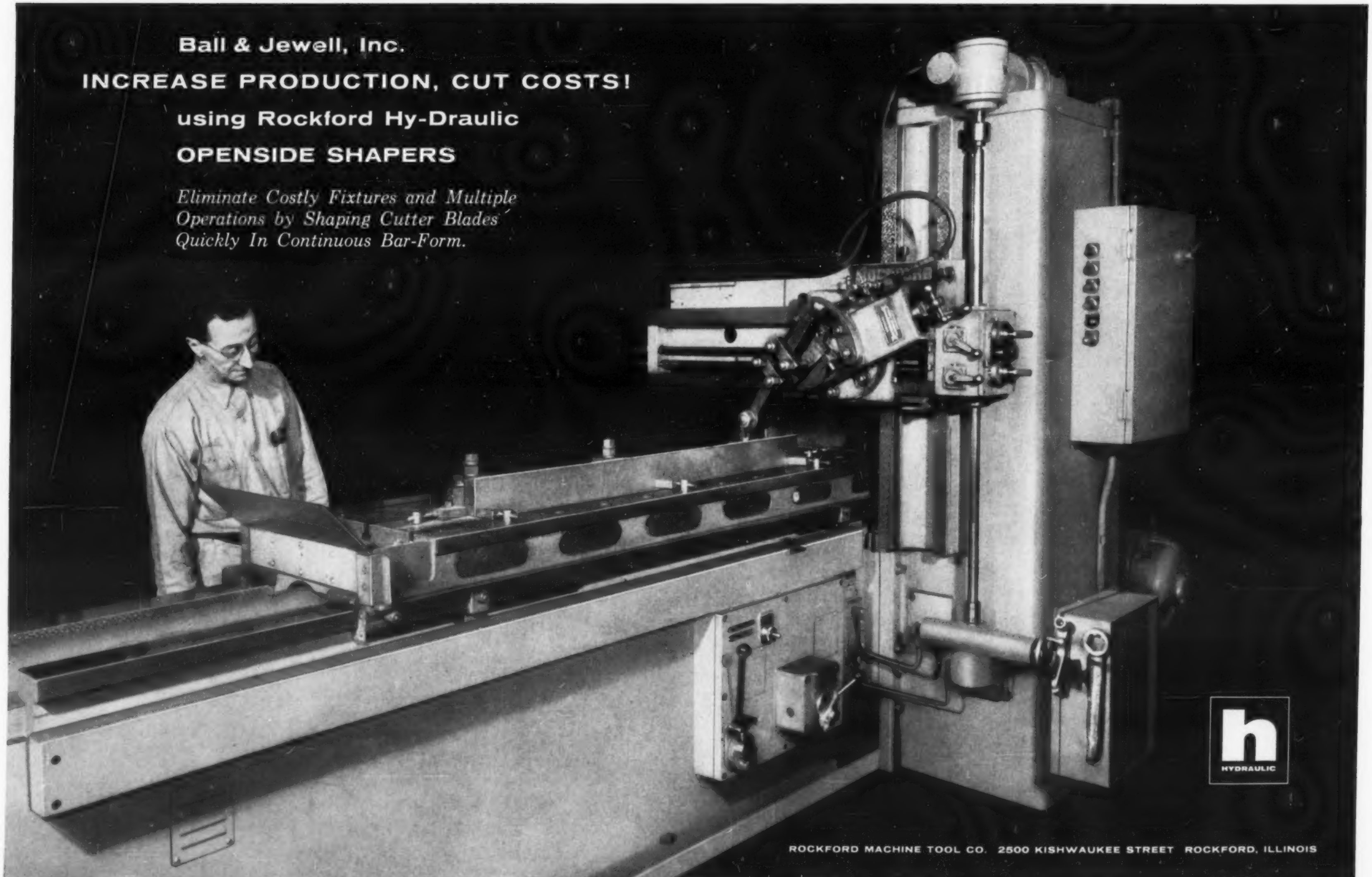
"We feel that we are stronger and in a better competitive position because we have never hesitated to retire a good machine in favor of a better one. In our specialized industry, a sound program of machinery replacement is a first requirement."

R. B. Stoner, *Vice President, Operations*
Cummins Engine Company, Inc.,
Columbus, Indiana



**Rockford Insert Group**

*Keep gathering metal-working production ideas ... be well informed when you replace machinery*



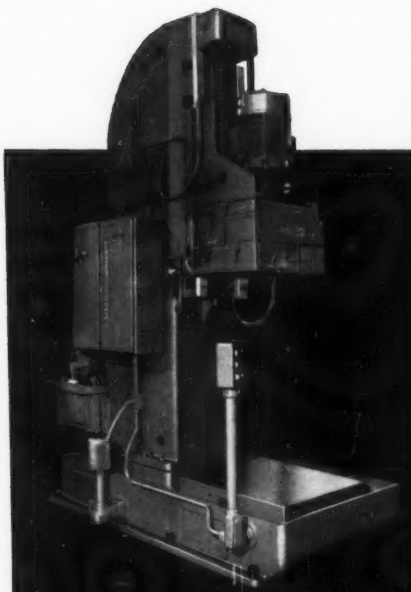

HY-DRAULIC



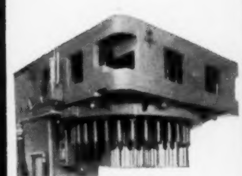
CENTER OF MACHINE-TOOL EXCELLENCE ROCKFORD, ILLINOIS, U.S.A.

# fast changeover!

provides continuous operation for small-lot runs on BarnesdriL hydraulic-feed, way-type Drilling Machines



Before you buy any drilling equipment, see these new BarnesdriL hydraulic-feed Drilling Machines. Auxiliary multiple-spindle heads, with adjustable centers and slip plates, give you quick changeover to the number of spindles and drill patterns you need to meet production schedules on small runs. No costly set-up or loss of production time is necessary. By taking advantage of this flexibility and quick production changeover which these machines offer, you can maintain continuous production operations with minimum cost per piece on a wide range of work.



50-Spindle Adjustable Center Auxiliary Head with Slip-Spindle Construction.

This machine arranged with 16-spindle auxiliary head, adjustable-center spindles and slip plates to employ any number of spindles in the pattern desired. Ease of changing production set-ups by substituting new slip plate and fixtures keeps machine operating full time.

## these features keep maintenance costs low!

Direct Motor Drive Eliminates Linkage

Ample Stroke Clearance for Easy Tool Changes

Hydraulic Cylinder Serviceable without Dismantling Unit

All Valves Flange-Mounted

Hydraulic System is Mannifold-Arranged

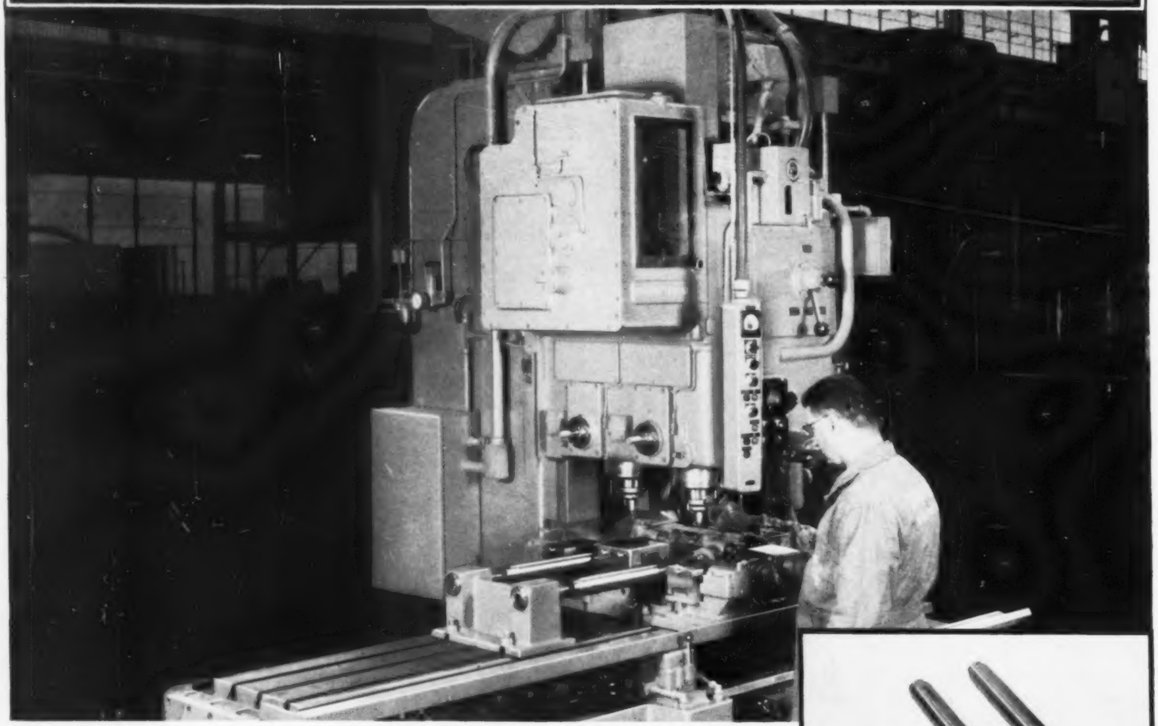
Ask for an estimate on processing your short-run drilling operations, using these new BarnesdriL Machines.

**BARNES DRILL CO.**

830 CHESTNUT STREET • ROCKFORD, ILLINOIS
DETROIT OFFICE: 13121 Puritan Avenue

**SUNDSTRAND**

# "ENGINEERED PRODUCTION" NEWS

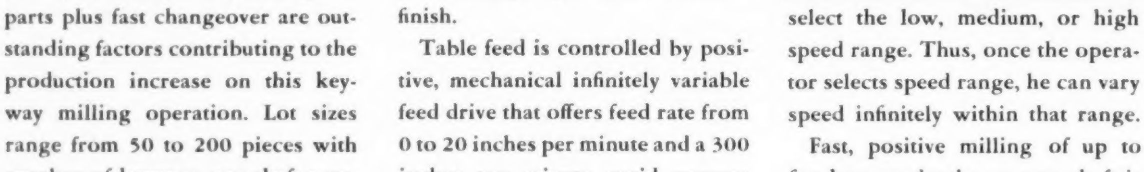


## Keyway Milling Time Cut 30% With Sundstrand Rigidmil

Ability to handle a wide range of parts plus fast changeover are outstanding factors contributing to the production increase on this keyway milling operation. Lot sizes range from 50 to 200 pieces with number of keyways per shaft varying from 1 to 5. In addition to reducing machining time an average of 30%, this Sundstrand two spindle Rigidmil simplifies the problem of maintaining required tolrance and finish.

Table feed is controlled by positive, mechanical infinitely variable feed drive that offers feed rate from 0 to 20 inches per minute and a 300 inches per minute rapid traverse rate. The same type of drive is provided for the spindle with speeds available ranging from 100 to 3000 rpm, using a manual shift lever to select the low, medium, or high speed range. Thus, once the operator selects speed range, he can vary speed infinitely within that range.

Fast, positive milling of up to five keyway depths on one shaft is insured by a turret stop on the head. For intermittent keyway milling, machine is provided with vertical feed.



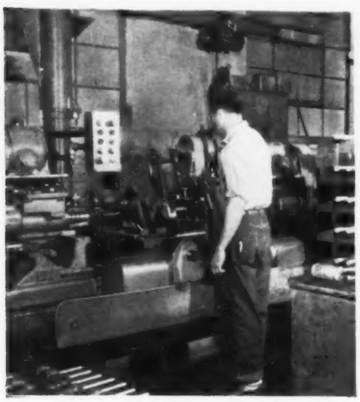



CENTER OF MACHINE-TOOL EXCELLENCE **ROCKFORD, ILLINOIS, U.S.A.**

## Milling and Centering Machine Boosts Crankshaft Output 2½ Times

With Sundstrand's application of "Engineered Production," major savings can be made in preparing work for machining operations to follow. An excellent example is provided in this installation for milling and centering crankshafts for heavy-duty, air-cooled engines.

Production is now at 400 crankshafts per eight hour shift compared with 152, using former methods. Because both ends are finished at the same time, machining time is reduced materially. In addition, because both milling and centering operations are performed in the same setup, accuracy is higher than with other methods. By eliminating the need for a second machine, floor space is saved and capital equipment requirements are reduced as well.



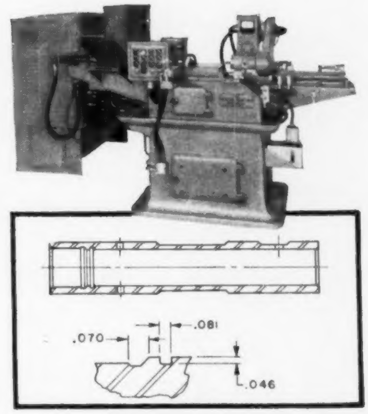
Both cutoff and centering of crankshafts are handled in a single setup on this Sundstrand machine.

Included in the complete line of machines designed for shaft preparation are single end machines for small lot work, double end machines for medium length runs, and broaching and centering machines for jobs where production requirements are high. Automatic loading and unloading can be provided where required for long run production.

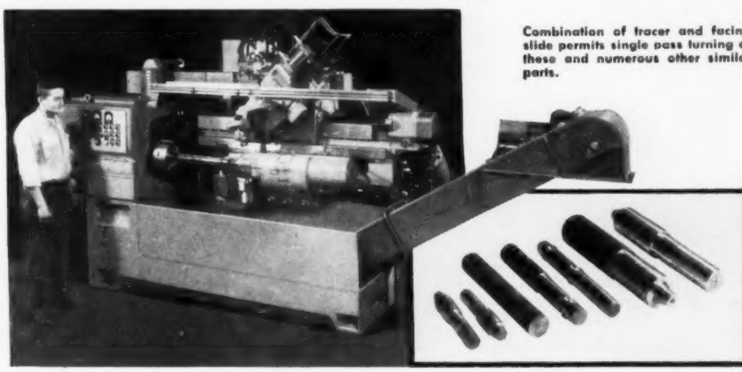
## Small Grooves Machined 110 Per Hr. on Thread Miller

Two internal grooves, too small for grinding, are milled and chamfered at 110 pieces per hour on this Hanson-Whitney special 4 x 9 hydraulic machine equipped with automatic loading and unloading. Material is SAE 1062 steel.

Two machines handled by a single operator now do the job that formerly required five machines with an operator for each. All that the operator has to do is load the chute. Workpieces are fed through the spindle, milled and ejected automatically.




Automatic feed and ejection of parts are handled on this Hanson-Whitney thread milling machine.



Combination of tracer and facing slide permits single pass turning of these and numerous other similar parts.

## One Lathe Replaces Three

It formerly took three machines to do the job now being handled by one Sundstrand tracer lathe in turning the various sizes of shafts shown in the inset. Parts range in size from 1½ to 6 inches diameter and from 18 to 36 inches long. Frequent changes in the size of parts being machined make the job ideal for the Sundstrand tracer lathe that requires only 10 or 15% the change-over time necessary on other machines. Valuable extra floor space is released and required tolerances readily maintained. The high metal removal rate makes the machine's suitability for automatic chip removal an important feature in maintaining uninterrupted production.

*Bulletin 602 describes the broad line of Sundstrand machine tools. Write for your copy today.*

BROACHING TOOLS BROACHING MACHINES PRESSES

**SUNDSTRAND MACHINE TOOL CO.**
2530 Eleventh St. • Rockford, Ill., U.S.A.


# *A Natural*

## on Greenlee Air-Feed Automatics

### *Feed Out Stock to 16½"*
### *Eliminate Pushers and Feed-Out Cams*

Removable fittings attach air lines to the stock reel tubes. A vacuum pump withdraws the piston when restocking. Push-button control panel is provided for starting and stopping.

Greenlee Air-Feed Automatics offer you a 3-way profit advantage:

1. Maintenance and change-over time is reduced by eliminating stock pushers, feed tubes and feed-out cams.
2. Stock can be automatically air-fed to position in one or more machining stations permitting two or more pieces per cycle.
3. Multiple feed-out flexibility enables you to finish machine a variety of pieces that ordinarily demand costly second operation setups.

If you are running into production headaches on a specific job, Greenlee may be able to adapt an "Air-Feed" to solve your problem. See your Greenlee Distributor.


Write for your copy of Catalog A-405 — first step on the way to more profitable production with Greenlee Automatic Bar Machines.

## Greenlee Standard and Special Machine Tools

- Multiple-Spindle Drilling and Tapping Machines
- Transfer-Type Processing Machines
- Six and Four-Spindle Automatic Bar Machines
- Hydro-Borer Precision Boring Machines
- Die Casting Machines

**GREENLEE** BROS. & CO. | 1741 MASON AVE. ROCKFORD, ILL.



MACHINES DESIGNED TO MEET YOUR NEEDS **ROCKFORD, ILLINOIS, U.S.A.**

# Are your lathes designed to profit from throwaway insert tools?

PROFIT POINT TURNING

## Real profits come from decreased tool-change downtime and increased machine speeds

You can take full advantage of the savings made possible by throwaway insert tooling — elimination of sharpening and resetting costs, and decreased tool-change downtime — if you have a modern, high-speed lathe designed for carbides and ceramics. Chances are savings in tool-replacement costs plus greater production due to higher speeds and increased rigidity will amount to thousands of dollars a year, enough to pay for the new lathes you need badly to take full profit advantage.

The use of conventional speeds with throwaway insert tools is *wasteful*. And your profits are pegged *low* if you're using them on 20-year-old lathes that are underpowered for high-velocity turning. With perishable-tool costs so low in comparison with the cost of operating a lathe, the only sensible thing to do is boost machine speeds . . . burn up the cutting tool faster . . . really trim the fat out of the part price.

The speed at which tool costs and machining costs are in balance is your PROFIT POINT (see example above). But to operate at the right speed you need power, precision, and rigidity in lathes used with throwaway insert tooling—advantages your company will be glad to pay for in order to save time, floor space, and cost.

In other words, why put throwaway insert tooling on a "throwaway profit" machine tool?

**Example of PROFIT-POINT Turning**

| Cost Item | Brazed Carbide | Throwaway Insert |
|---|---|---|
| Tool-change time | 5 min. | 2 min. |
| Cost per cutting edge | \$1.27 | \$.25 |
| Minimum cost tool life | 40.4 min. | 11 min. |
| Cutting speed for PROFIT-POINT turning | 720 fpm<br>1000 rpm | 980 fpm<br>1360 rpm |
| Machining time per piece | 1 min. | .74 min. |
| Tool time per piece (including nonproductive time per piece) | 2 min. | 1.74 min. |
| Machining cost per piece | \$.15 | \$.11 |
| Total cost per piece | \$.031 | \$.017 |
| Nonproductive cost per piece | \$.15 | \$.15 |
| Pieces machined per hour | 30 | 34 |
| TOTAL COST PER PIECE | \$.331 | \$.278 |

## Barber-Colman's new 36-speed lathe is designed for PROFIT-POINT turning

Here's the machine that will give you precision work at the high speeds required for PROFIT-POINT turning with throwaway insert tools!

Look at the cross girth of the bed, extra-heavy cross slide, and rugged tailstock. Consider that this lathe will pull up to 25 hp through the spindle and operate at speeds up to 2000 rpm — yet you can get toolroom accuracy. And all the toolroom features, too, including: (1) multiple-thread indexing spindle, (2) built-in thread-chasing dial, (3) 66 threads, from 2 to 120 per inch, (4) reverse lever on apron, (5) automatic micrometer stops, (6) ball-thread-chasing stop on cross-feed screw, (7) hardened and precision-ground cross-feed screw and compound screw, (8) automatic, filtered lubrication to half nuts.

There are 36 spindle speeds through the geared head and 66 feed and thread changes, selected easily through two dials on the headstock. Write for complete facts on how this new Barber-Colman precision lathe will pay for itself quickly with throwaway insert tooling.


Now in production in two sizes, to swing 21 in. over the bed ways and 13 in. over the cross slide, or 25 in. over the bed ways and 16 in. over the cross slide.

**Barber-Colman Company**
42 Loomis Street, Rockford, Illinois

*Don't expect a day's work for a day's pay on yesterday's machine tools*

BARBER COLMAN

PRECISION LATHES



FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**

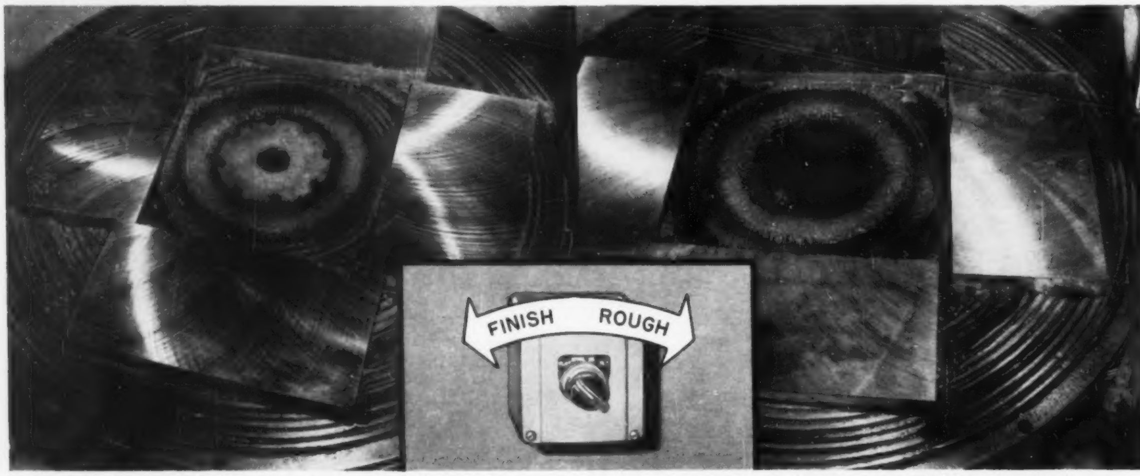
MATTISON HIGH-POWERED PRECISION

GRINDING METHODS

# New grinding method

## speeds production, increases accuracy...or both

### Mattison's Quick®-Tilt spindle gives you two operations for less than the price of one




Characteristic cross-hatching shows how accurately the power-tilting device returns the wheel to the flat position.

Operator just turns the selector switch to tilt the spindle back to vertical for finish grinding and sparking out.

Harder wheels and higher downfeeds were used in roughing these large, mild steel plates on the Mattison "No. 24."

**Mattison's new "Quick-Tilt" spindle changes the entire economics of surface grinding. Machines equipped with up to 60 hp spindle motors are designed to cut metal, not "scratch it." Higher downfeeds can be used to increase production by as much as 50%.**

Want to replace an obsolete vertical spindle surface grinder with a machine that improves all aspects of metal removal? Here is a machine that will increase your production without compromising flatness. In fact, it probably will improve both.

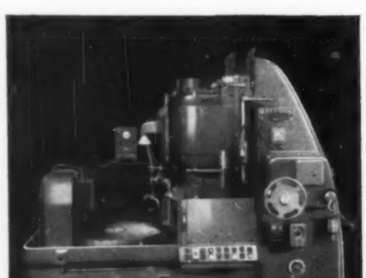
Perhaps your management wants more than an outsider's production estimate before approving a replacement proposal. Mattison will give you conclusive evidence of performance *on your job*, at no obligation other than the cost of shipping sample pieceparts to Rockford.

We will set up your parts on a grinder equipped with the most profit-significant new feature in 60 years—our automatic, power-actuated, Quick-Tilt spindle. You can see first hand, on your own pieceparts in the Mattison Methods Laboratory, how surface grinding can be changed from a "metal-scratching" operation to a profitable metal-cutting operation.

If you are a grinding man, you know that it takes pressure backed up by rigid machine construction to hog off metal with an abrasive wheel . . . and our No. 24's and 36's have more "beef" in the right places than any similar machines.

To this, we have added the Quick-Tilt spindle which really consolidates all of the advantages of power and rigidity. With the flick of a switch, you can tilt the spindle .008 to .010 in. above and below center, reducing the contact area between the wheel and the work. This permits you to start your job by taking a harder cut, grinding freely without danger of heat-checking—tearing out dull grits automatically to reduce the number of wheel dressings. This means higher downfeeds—faster production.

As your parts approach size, the automatic sizer shuts off the machine and the operator turns the selector switch to "flat." This tilts the spindle back to the true vertical position for grinding out all concavity. In less time than it takes to do a roughing operation on a conventional grinder, you get pieceparts which are dead flat on a 36" or 48" diameter.




Mattison "No. 24" has a rigid one-piece column which starts at the floor. Only the wheel head tilts.

### 60 hp on the No. 24

The Mattison "No. 24," with 18" capacity under the wheel (24" optional), is available with 42" table plus these important new features:

1. Continuous downfeed
2. Automatic cycling
3. Air gage measuring
4. Separate coolant tank
5. Fully protected ways

Here is a machine that reduces nonproductive time for wheel changing and dressing . . . virtually eliminates downtime for cleaning . . . and increases both productivity and accuracy.

Tell your Mattison dealer you want sample pieceparts ground in our Methods Laboratory on a Quick-Tilt machine. He will make all the arrangements for a convincing test which costs you nothing but the freight. Or, phone the factory direct.

**MATTISON MACHINE WORKS**
Rockford, Illinois WOodland 2-5521

MATTISON MACHINE WORKS ROCKFORD ILL. U.S.A.

**HIGH-POWERED PRECISION SURFACE GRINDERS**



MACHINES DESIGNED TO MEET YOUR NEEDS ROCKFORD, ILLINOIS, U.S.A.

FOR PRODUCTION MACHINE TOOLS IT'S **ROCKFORD, ILLINOIS, U.S.A.**


TOOL carbide NEWS

- *Slash Tool Costs*
- *Increase Output*
- *Eliminate Grinding*
- *Cut Tool Change Time*

# WESSON Now Has 144 Standard Boring Bar Models

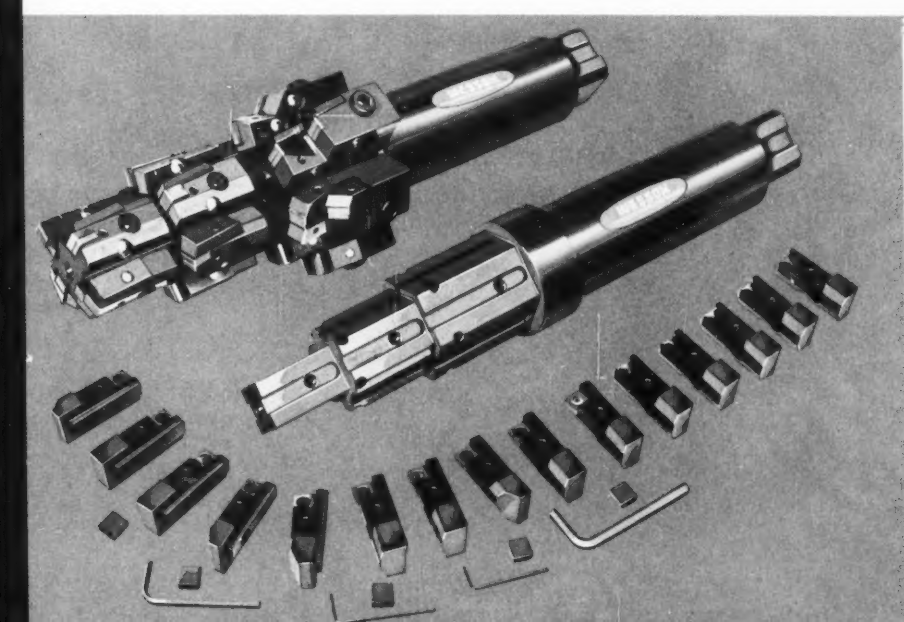
Rapidly growing demand for Wesson boring bars with throw-away carbide inserts has resulted in the standardizing of 144 models in four basic styles for quick delivery . . . and an end to your boring problems.

The new standard line includes 96 models that combine expendable inserts with precision adjustment for OD's. Bore diameters range from 1.50 to 2.60″. Either square or triangular inserts can be adjusted outward for a total range of 0.100 to 0.200″, depending on diameter. (Anvils and clamps for round inserts are available on request.) Right- and left-hand models are available for either deep-hole boring or shallow boring.

The Micro-Adjustable assembly is actuated by a screw with a head graduated in 0.001-inch divisions, guided by a keyway and held rigidly by a locking screw. High boring accuracy is assured with this quick, simple adjustment.

Where adjustability is not needed, there are 48 standard models in two basic designs for straight boring with a lead angle (square inserts), and for boring and facing (triangular inserts). These styles have either positive or negative rake angles.

*Write for Bulletin MB-1158 for data on standard Micro-Adjustable and nonadjustable boring bars using throw-away carbide inserts.*



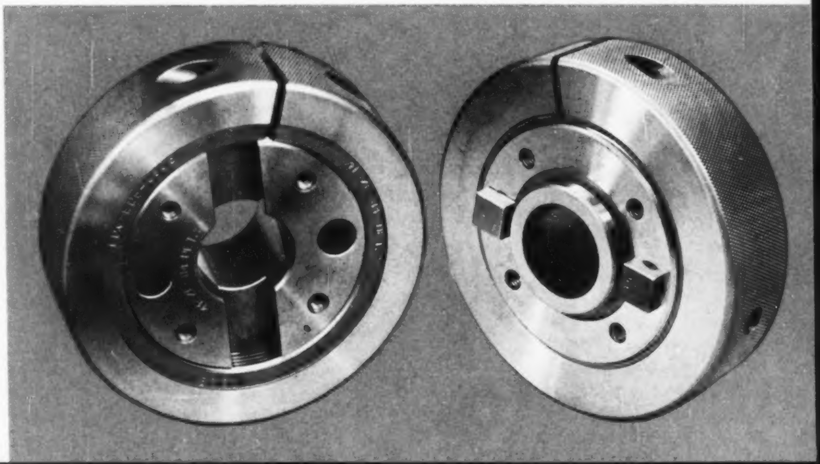
## Combine Operations in One Tool

The adjustable throw-away insert principle can be adapted to a limitless variety of tools combining different operations. At left, is a complete tool—and all its components—for making 15 simultaneous cuts. Replaceable throw-away insert holders, ground to 0.001-inch tolerances and infinitely adjustable on both axial and radial dimensions, bore 3 steps, end face and chamfer automotive steering-gear housings at the Indianapolis plant of Chrysler Corp.

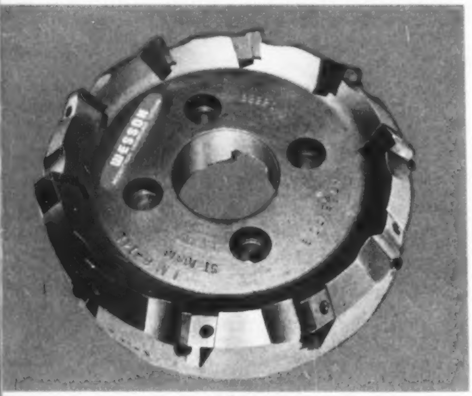
## TOOL carbide NEWS

# 1 DO YOU GRIND FACE MILLS?
## These adaptors will save you money

With the new Wesson Rigidcut micro-adaptors for milling cutters you can grind cutters an average of 4 times before re-setting the blades—also eliminates the need for costly adjustable milling cutter spindles. Permits presetting cutters on the bench. Total adjustment available is 0.125 in. Adaptors available for cutter diameters from 4½ to 12 in. Manufacturing precision is such that concentricity (indicated total runout) and squareness with face are held to within 0.0005 in. Ask for Bulletin 158.



# 2 WANT TO STOP GRINDING FACE MILLS?
## Throw-aways are the answer on many jobs




***The cutter . . .***

Reduce your cutter inventory. Rough or semi-finish cast iron or steel—*all with the same cutter body.* Just change the Wessonmetal throw-away inserts. Each insert has eight cutting edges. Inserts are backed by quickly replaceable low-cost hardened steel anvil-wedges designed to protect the cutter body against accidental damage. Cutters available in 4 lead angles—15, 30, 45 and 87 degrees. Ask for Bulletin #358-M.

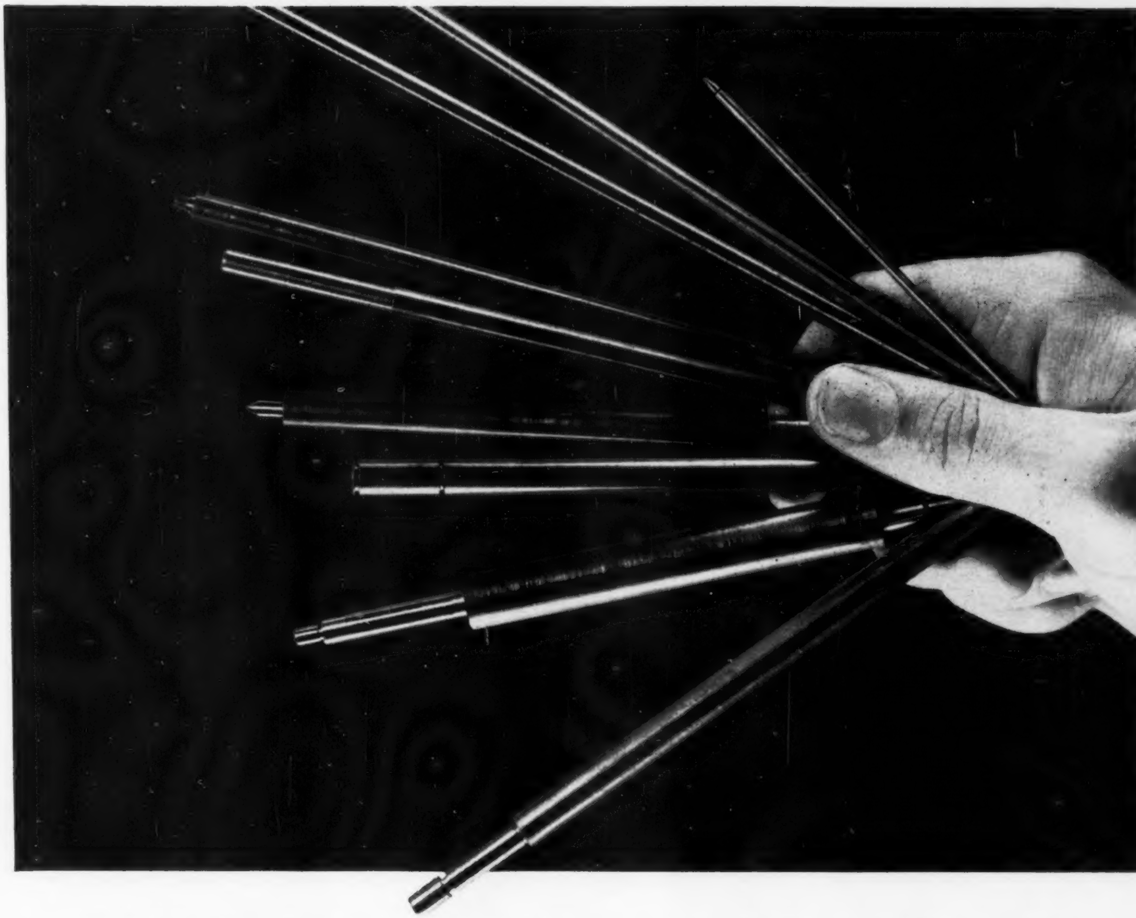
***How it locks . . .***

***How it protects . . .***

tools Wesson
carbide Wessonmetal

**WESSON COMPANY, DEPT. AD**
1220 Woodward Heights Blvd., Detroit 20, Mich.
*IN CANADA:*
**WESSON CUTTING TOOLS, LTD.**
93 Judge Road, Toronto 18, Ontario

LITHO IN U.S.A.



## Which will inspect these shafts faster... mechanical or optical gaging?

Over 25 different metal shafts go into the calculators made by Monroe Calculating Machine Company.

In the past, inspection of these shafts required the use of a large number of "go" and "no-go" gages. Rate? *About 7 per minute.* In addition, gage surveillance was both time-consuming and expensive.

Then the switch was made to optical gaging, using a Kodak Contour Projector. The method is simple: A master shaft is positioned to either upper or lower tolerance limits on the screen. Then the part to be inspected is placed in the same position.

Rate with optical gaging? *About 17 per minute!* And, there's no longer a need to send gages back to the crib for resetting. One Kodak Contour Projector does the whole job.

Besides saving time, optical gaging with a Kodak Contour Projector offers you a chance to *cut* down on gage costs, use operators with little or no training, and often obtain accuracy *not* possible by other means.

Where can you use optical gaging? Almost *anywhere* in the plant—receiving, assembly, production, final inspection, toolroom.

Facts about Kodak Contour Projectors are spelled out in a brochure which you can get by writing to the address below. After you've had a chance to look over the contents of the book, we'd like to demonstrate *why* and *how* one of the six Kodak models will best fit your inspection needs.

**Use of low-cost Model 8 Kodak Contour Projectors enabled the Monroe Calculating Machine Co., a division of Litton Industries, to more than double inspection rates.**

**Special Products Sales**

**EASTMAN KODAK COMPANY, Rochester 4, N. Y.**

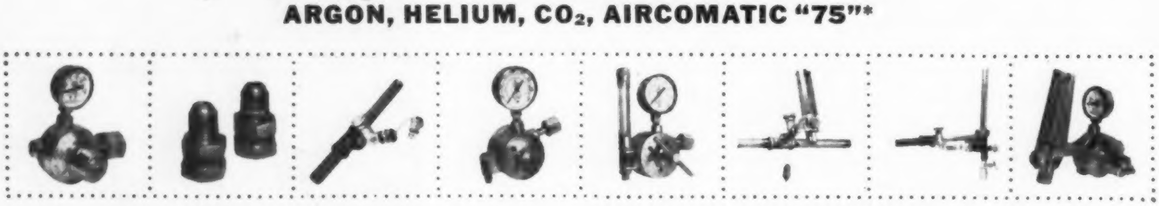
# the KODAK CONTOUR PROJECTOR

Kodak
TRADEMARK



**For more data, circle this page number on inquiry card**


**WITH AIRCO'S
COMPLETE LINE OF CONTROL DEVICES FOR
ARGON, HELIUM, $CO_2$, AIRCOMATIC "75"***



**Single-Stage Fixed Pressure Regulator** Low in cost . . . sturdy. No flow rate tampering.

**Flow Adapter**—Exact gas flow needed. Prevents tampering . . . saves.

**"B" Station Valve for Flow Adapter**—reliable shutoff. Compact, sturdy, versatile.

**Fixed Pressure Two-Stage Regulator**—exact gas flow needed. For two operations.

**Two-Stage Flowmeter Regulator**—complete flow coverage for virtually all uses.

**Station Flowmeter**—complete coverage. Low cost . . . extremely rugged.

**Dual Range Flowmeter**—complete coverage. Versatile, excellent readability.

**Single-Stage Flowmeter Regulator**—Rugged, compact. No heater required for $CO_2$.

*75% Helium, 25% Argon

VISIT OUR BOOTH 521 APRIL 7-8-9, '59
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Sponsor: AMERICAN WELDING SOCIETY, INC.
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For full particulars on how to specify the most economical Airco Gas Equipment for your application, see your Authorized Airco Dealer, or write to Airco direct. Ask for the new Gas Flow Control Equipment Catalog. It's free.

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XLO EX-CELL-O FOR PRECISION

B

C

A

D

F

A. Standard DB 24 Spindle
B. DB 50 Motorized Spindle
C. DB 25 Square Body Spindle
D. DB 50 Motorized Quill-Type Spindle
E. DB 22 Square Body Spindle
F. Standard DB 22 Spindle

E

57-90

# Greater Accuracy—with Ex-Cell-O Precision Boring Spindles

No one need tell you of the proven superiority of Ex-Cell-O precision boring spindles where close tolerances and fine finishes are required. But, did you know that these same Ex-Cell-O boring spindles have been used as replacement units for years?

Produced in belt-driven, standard motorized, or high frequency motorized styles, these Ex-Cell-O precision spindles are equipped with XLO Precision bearings for maximum spindle rigidity, long life and smooth operation. Permanent bearing lubrication reduces maintenance costs, prolongs bearing life.

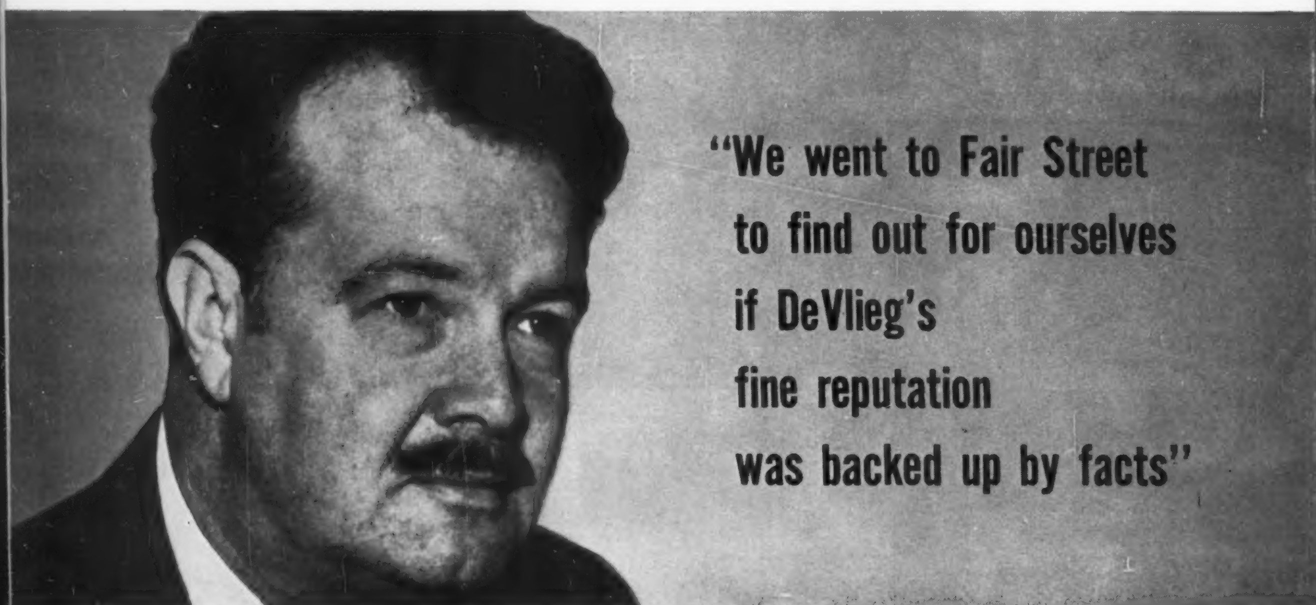
For complete information, why not get in touch with your local Ex-Cell-O representative or, if you prefer, send direct for bulletin 25477.

EX-CELL-O CORPORATION
DETROIT 32, MICHIGAN
Machinery Division

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES
CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS
AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

**GUSTAV VON REIS,** President
Detroit Broach & Machine Co.

# a man who came to Fair Street



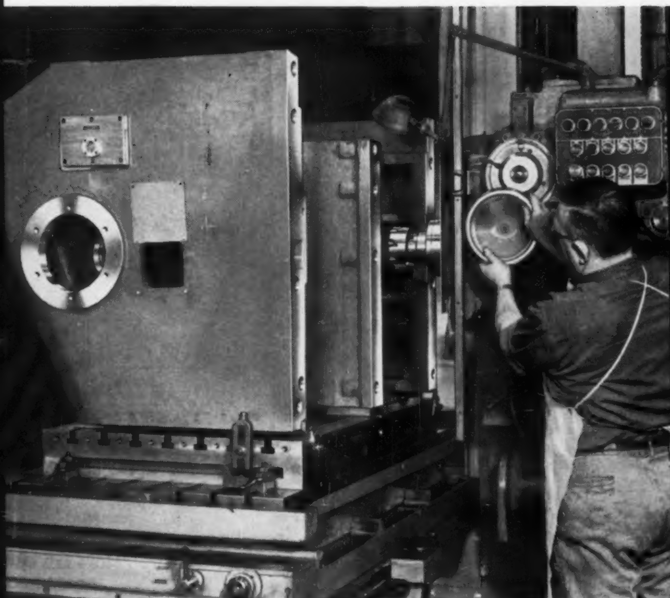

"We were convinced. We purchased two JIGMILS and they have now been in operation for several years. These machines have all the fundamentals required to produce the highest degree of accuracy, and yet, are simple to operate. Besides this, and we feel most important of all, the JIGMIL has special features which largely eliminate our reliance on the human element to produce close tolerance work. JIGMILS enable us to produce our broaching machines and broaching tools to the very highest degree of accuracy, a matter of the utmost importance in our products."

GUSTAV VON REIS

**DE VLIEG MACHINE COMPANY,** FAIR STREET **ROYAL OAK, MICHIGAN**

**SOME OF OUR JIGMIL USERS**

Akramatic Engineering
American Mach. & Tool Co.
Apex Corp.
Barker Tool Die & Gauge Co.
Base Tool & Gage Co.
Bengal Boring Co.
Best Tool & Engineering Co.
B. H. Aircraft Co., Inc.
Black Rock Mfg. Co.
Bradley-Thompson Tool co.
City Pattern Foundry & Mach. Co.
Compton Boring Co.
Crest Tool Industries, Inc.
Dearborn Tool & Die Co.
Detroit Gauge & Tool Co.
Detroit Jig Grinding Co.
Eglinton Carbide Products, Inc.
Ensign Tool & Gauge Inc.
Evans Tool & Die Co.
Fuller Tool Co.
Glendale Machine & Tool Co.
Hiser Jig Grinding Co.
Jameson Machine Co.
Jones Tool Products
Lamina Dies & Tools, Inc.
Langlois Tool & Die Corp.



## A FEW PROVEN ADVANTAGES OF THE JIGMIL TECHNIQUE

- Eliminates cost of expensive jigs and production delays resulting from their manufacture.
- Simplifies tooling.
- Employs automatic functions to reduce factors of human error even in close tolerance work.
- Makes possible greater flexibility of product design.
- Improves end product by permitting interchangeable assembly of parts without hand fitting.
- Increases production and product accuracy.

**ACCURACY IS AN ECONOMY!**

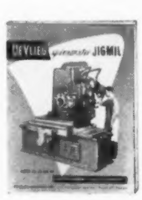
### JIGMIL—EXTREME ACCURACY ON LARGE, WEIGHTY PARTS FOR DETROIT BROACH

Broaching machine knee, 65" long, weight 5500 lbs., set-up on a 32" x 60" index table on a Model 4B-72 JIGMIL. The knee is rough and finish milled, bored, drilled and tapped from four sides in one set-up. Formerly machined on a conventional boring mill, the job took 120 hours. The JIGMIL now completes all machining operations in 50 hours with consistent accuracy and without special tooling. Furthermore, the accuracy achieved effects substantial reductions in assembly time and improves the quality of the end product.

Maks Machine Co.
Mark Twain Tool & Mfg. Co.
McDonnell Machine Products, Inc.
Modern Industrial Eng. Co.
Mohawk Metal Forming & Tool Corp.
Mt. Clemens Mfg. Co.
Olofsson Tool & Die Co.
A. E. Parker & Sons Co.
Precision Boring Co.
Product Engineering & Mfg. Corp.
Progressive Industries Co.
Schwartz Mach. Co.
Special Machine & Eng., Inc.
Tragge Boring Co., Inc.
Turner Bros., Inc.
Vulcan Eng. Co.
Westfield Tool & Eng. Co.

WILL YOU BE THE NEXT TO VISIT FAIR STREET

Our newest catalog will help you decide. May we send it?




# DeVlieg

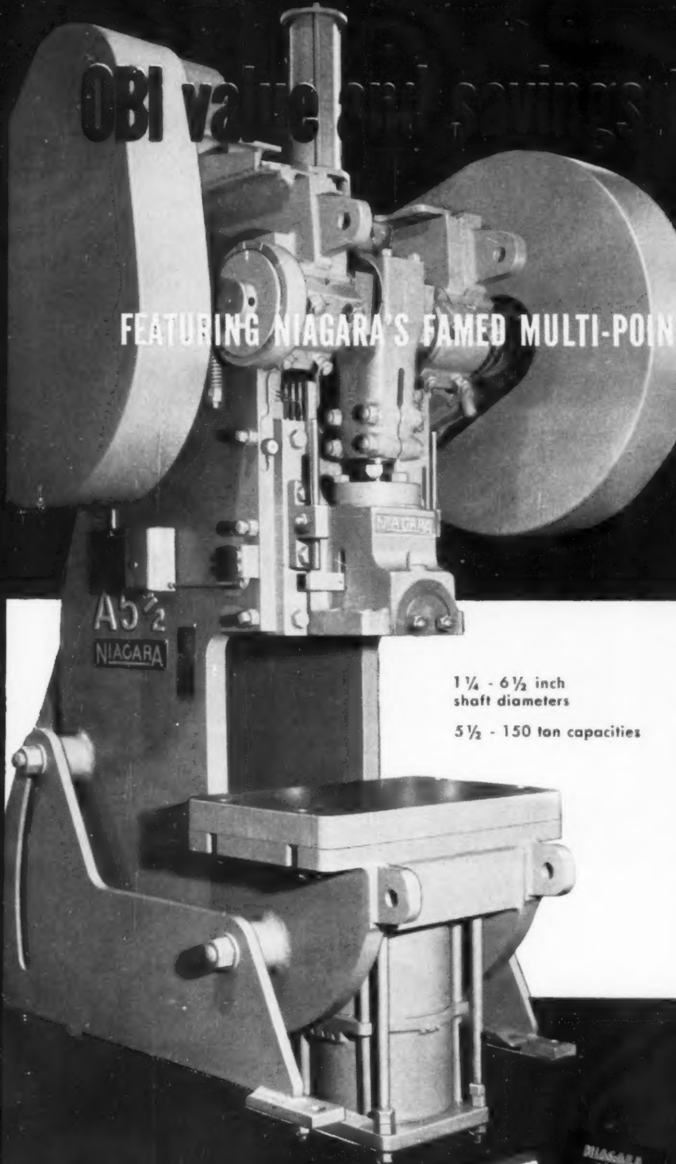
## SPIRAMATIC JIGMILS®

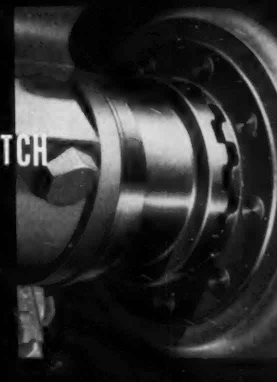
ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

For more data, circle this page number on inquiry card

# TON FOR TON . . . DOLLAR FOR DOLLAR

## OBI value and savings that can't be matched





### FEATURING NIAGARA'S FAMED MULTI-POINT MECHANICAL SLEEVE CLUTCH

Picks up load on 14 engaging jaws. Applies driving force concentrically without keys or pins. Assures instant engagement and maximum productive strokes per minute. Needs no air nor electricity. Practically no maintenance. Greater safety: Simplified controls, fewer parts to wear out. *Yes, it permits, inching, too.*

1 ¼ - 6 ½ inch shaft diameters

5 ½ - 150 ton capacities

Here's a workhorse that's known for setting the pace on the most demanding jobs . . . jobs where the clutch is engaged and disengaged at every press stroke . . . jobs that call for operation three shifts a day, day in and day out.

Built and *backed* by a company which produces industry's greatest variety of inclinables*, Series A Presses have amassed an unusual success record in thousands of applications. To be specific, let's take a close look at a Series A user:

28 OBI'S SINGLE STROKED 707,140,000 TIMES WITHOUT ONE CENT SPENT ON CLUTCH ENGAGING SURFACES

### GET THE FULL REPORT

NIAGARA MACHINE & TOOL WORKS, BUFFALO 11, N.Y.

# NIAGARA (SERIES A) OBI PRESSES

Acme-Gridley 1¼" RA-6 bar automatic producing 300 valve stems per hour.

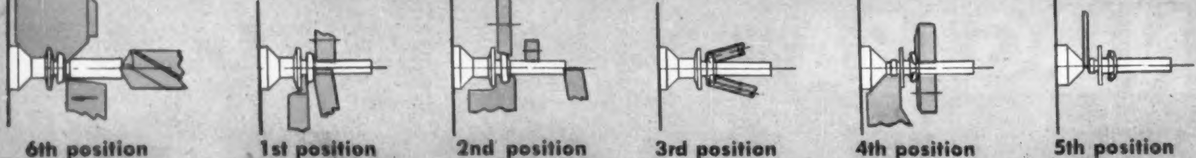
Special Namco-designed multiple end milling attachment in the 3rd position.

*When Tolerances and Finish*

*Looked Economically Impossible*

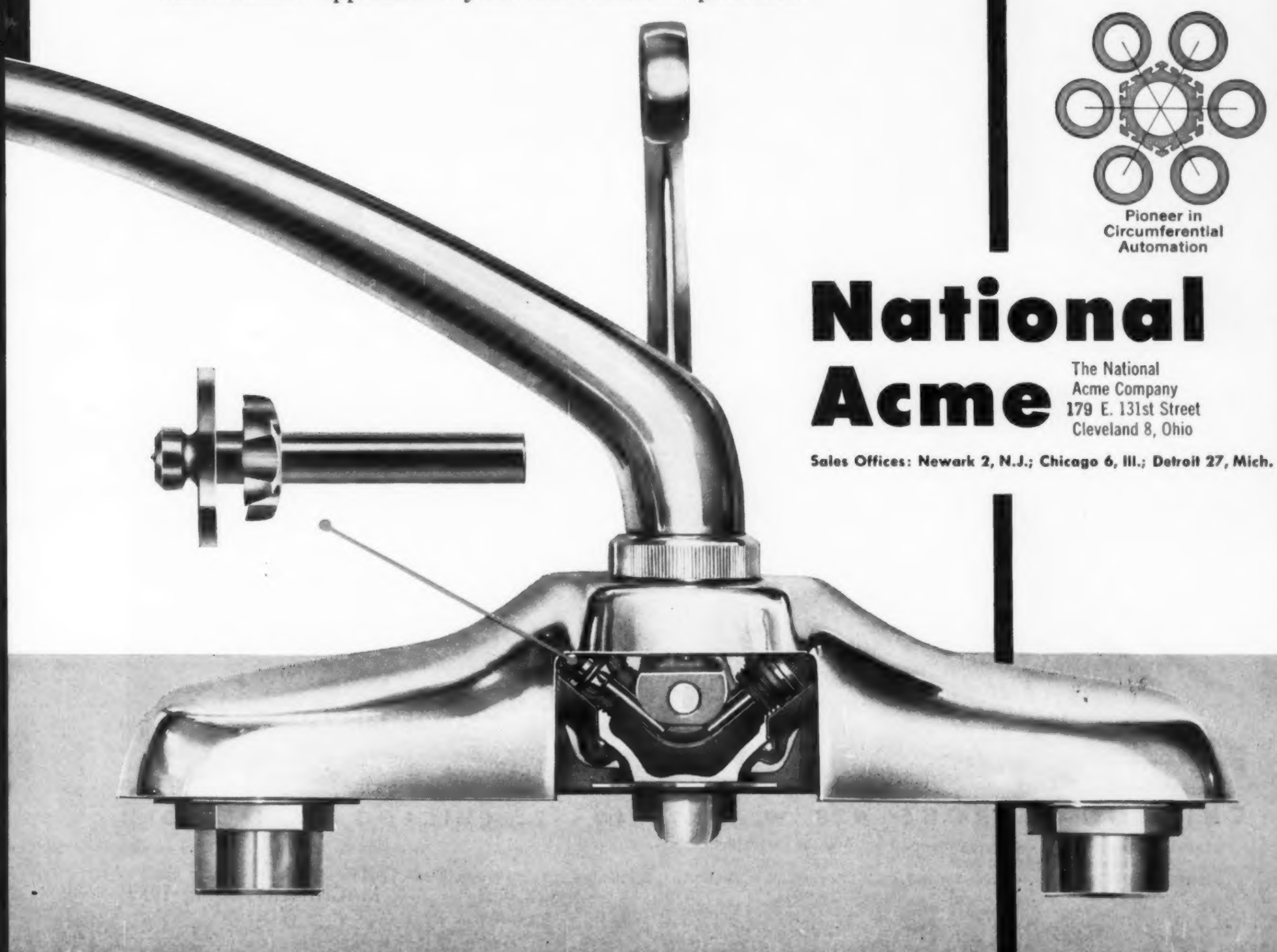
# AMERICAN-STANDARD TURNS TO ACME-GRIDLEY...

**10 Operations in 12 Seconds**

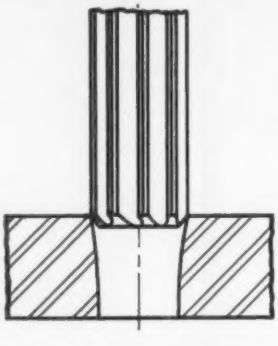


| 6th position | 1st position | 2nd position | 3rd position | 4th position | 5th position |
|---|---|---|---|---|---|
| Rough form rear —rough turn stem —spot drill | Finish turn stem face large diameter | Shave—face and chamfer stem end | Stop spindle—mill six slots | Start spindle—burnish stem—form back end | Cutoff |



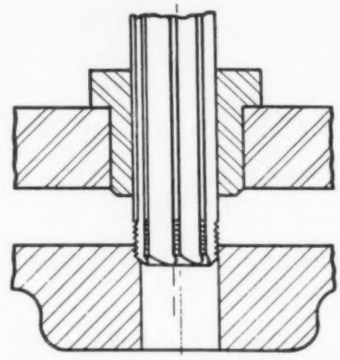


# REAMING TIPS YOU CAN USE



When a hole is to be reamed, check handbook recommendations on size of drill to use. A reamer works best, and lasts longer, when there is adequate stock left for reaming. Avoid tapered or bell-mouthed holes (caused by improper drilling) that cause excessive reamer wear.

Protect reamers at all times. The chamfers or cutting edges and the accurately ground surfaces of the margins will be damaged if mishandled. Good shop practice is to save the sturdy tubes in which the reamers were originally packed. When not in use, keep reamer in its own labeled tube.

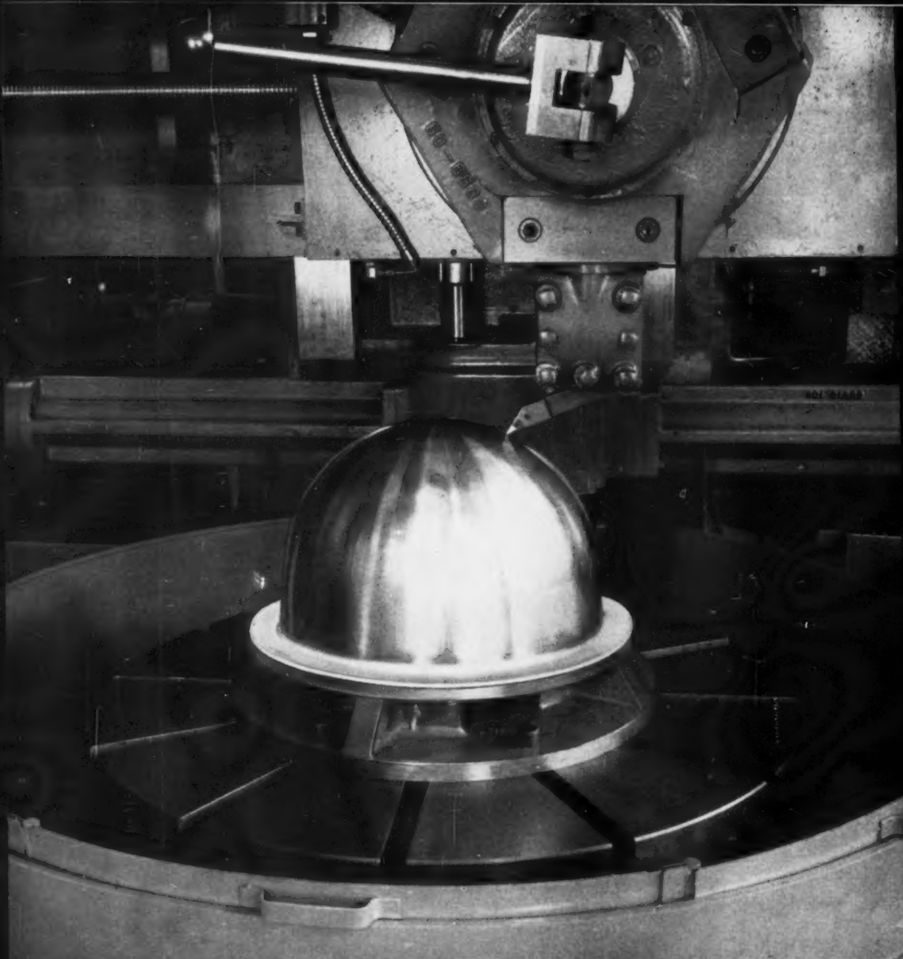


Misalignment between the reamer and the drilled hole can create two problems: 1. Wear on the reamer that takes the form of a thread . . . with depth equal to amount of misalignment; 2. Poor finish in reamed hole. *Always* check alignment of drilling and reaming fixtures.

FOR QUICK SOLUTIONS TO **ALL** YOUR DRILLING-REAMING PROBLEMS,
SEE CHICAGO-LATROBE CATALOG No. 58, OR CONSULT A C-L SERVICE ENGINEER

## BEST TIP OF ALL . . .

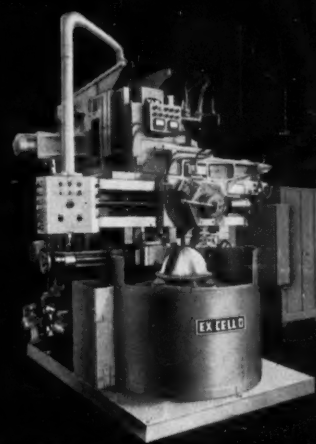

**CHICAGO-LATROBE 428 W. ONTARIO ST., CHICAGO 10, ILLINOIS**



XLO

EX-CELL-O FOR PRECISION

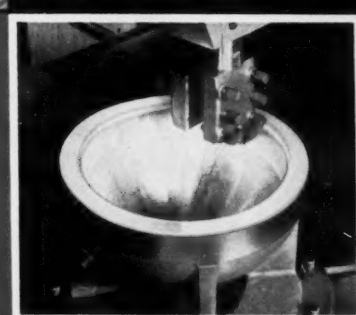
LEFT: Single tracer-controlled tool contours aluminum forging to .080" wall thickness holding .001" tolerance inside and outside.




ABOVE: Compact Vertical Contouring Machine handles medium or large workpieces. Slim cabinet at right side holds electronic tracer controls.

# Critical Contour Tolerances?

## HOLDS WITHIN .001" OF TRUE CONTOUR—INSIDE AND OUT



Close-up shows Style 416 contouring the inside surface. Workpiece is held in a vacuum fixture mounted on the machine table.

58-7

Contouring within .001" of true contour—inside and out—*without waste* requires the kind of precision built into an Ex-Cell-O Style 416 Vertical Contouring Machine.

The aluminum forging illustrated was first contoured on its periphery with a single electronic-tracer-controlled tool, then precision-finished inside to .080" wall thickness.

Designed for contouring hemispherical or irregularly-shaped surfaces, Ex-Cell-O Style 416 Machines also face, bore, turn, groove and chamfer with automatic cycling between loading and unloading.

Call your local Ex-Cell-O Representative, or write directly to Ex-Cell-O for information on other Precision Vertical Boring Machines.

**EX-CELL-O CORPORATION**
DETROIT 32, MICHIGAN

*Machinery Division*

MANUFACTURERS OF PRECISION MACHINE TOOLS • GRINDING AND BORING SPINDLES CUTTING TOOLS • TORQUE ACTUATORS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT


# Get new-forging performance at 1/3 the cost from ERIE FOUNDRY REBUILDING SERVICE

Here at the Erie Foundry Rebuilding "Hospital", we disassemble and inspect your forging hammer, remachine worn surfaces, true bearings, replace broken parts, repair cracked parts. Once the hammer is reassembled, tested and put back in operation, it'll be as spry and sound as a new machine—but at one-third the cost!

Stands to reason that the leaders in forge manufacture for over 60 years should be the best source for forge repair.

Regardless of who made it, or how badly it's cracked, broken or worn, your forging hammer will recover most quickly at Erie Foundry's Rebuilding "Hospital". Write for the complete story.

ERIE

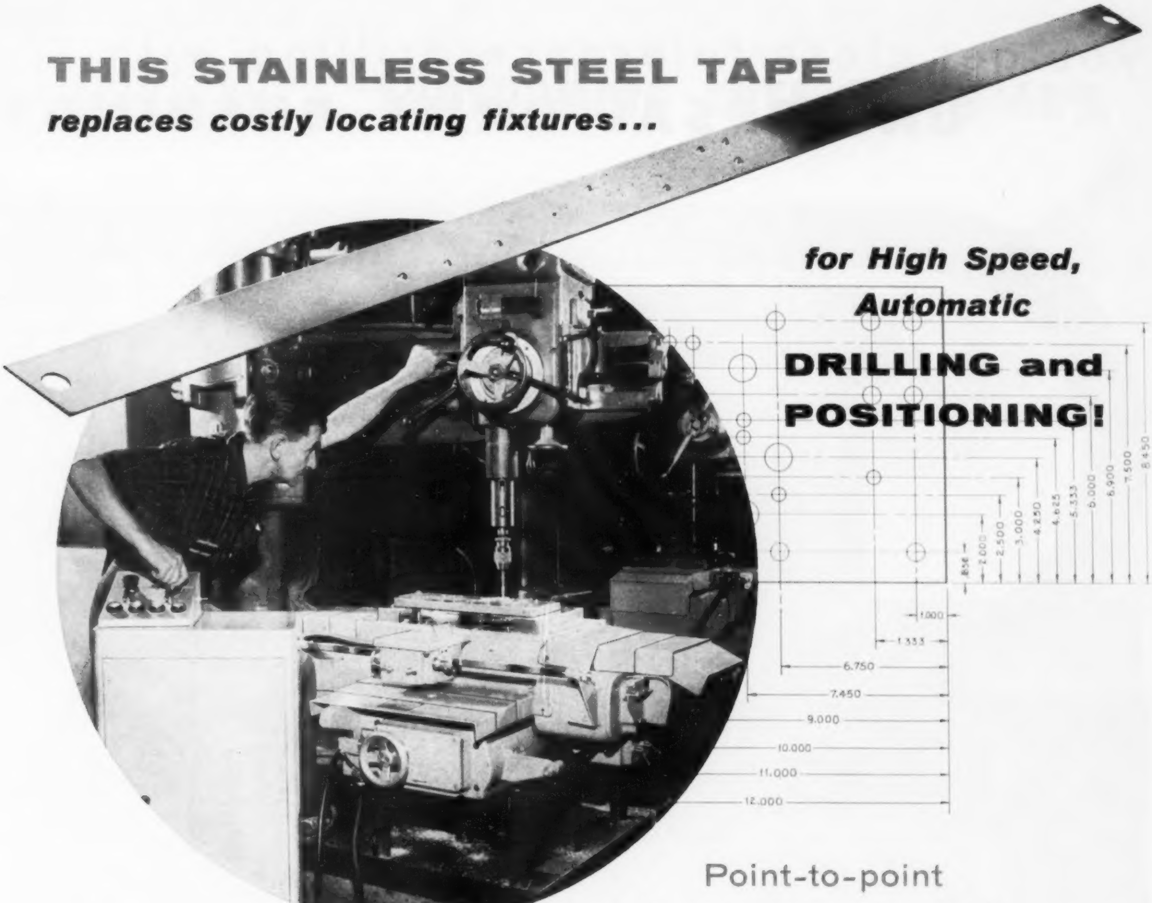
THE WORLD'S GREATEST NAME IN FORGING SINCE 1895

**ERIE FOUNDRY CO.**
**ERIE 5, PA.**

EF-59-02

# THIS STAINLESS STEEL TAPE

***replaces costly locating fixtures...***

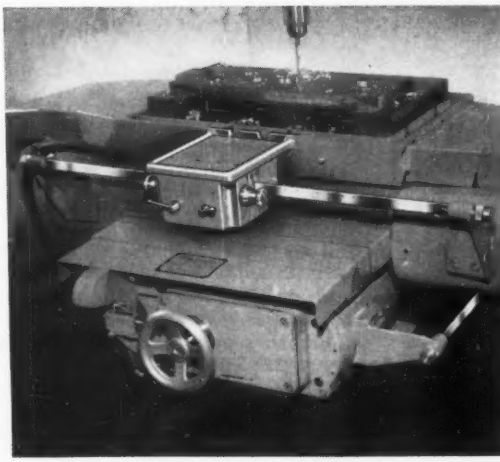



***for High Speed, Automatic***

**DRILLING and POSITIONING!**

Point-to-point
2-axis operation with

## MICRO-POSITIONER



MICRO-POSITIONER automates many shop operations at relatively *low cost*. It positions automatically, rapidly traversing at 90" per minute, dropping to 6" per minute approach speed. MICRO-POSITIONER may be used with any vertical spindle machine; locates accurately for drilling, boring or reaming to ±.001"—*without need for drill jigs!* Also mills in straight line paths using vertical head machines.

Simple to program, the operator merely indents two removeable stainless steel tapes as each table location is successively reached. Two accumulating readers indicate positions on both table axes and indentations instantly are produced by push-button controls. Tapes are quickly exchanged—can be re-used indefinitely for duplicate parts.

16" x 24" table, 14" x 18" traverse. (Other capacities available.) Complete with console and controls for indenting, stop, jog, and run operations.

MICRO-PATH INC.

*A Subsidiary of Topp Industries Inc.*

4949 West 104th Street • Inglewood 2, California
Phone: SPring 6-0450

*ASK FOR LITERATURE*



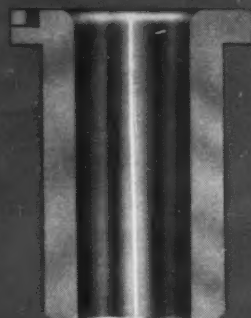
For more data, circle this page number on inquiry card

you get close tolerance drilling with

# UNIVERSAL DRILL BUSHINGS

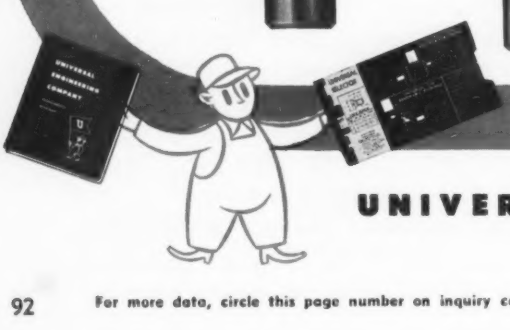
Accurately machined bushings are essential when drilling to close tolerance. UNIVERSAL DRILL BUSHINGS, of finest quality steel, are carefully tested for 100% concentricity and hardness, assuring pin-point accuracy and uniform quality. To prevent tool hang-up and breakage, each bushing has a blended radius on the top inside diameter.

All bores are superfinished. This superfinishing of bushings is important, especially in close tolerance work, because it reduces both tool and bushing wear to a minimum. Knurled head gives a quick, sure grip.



We stock drill bushings in all standard sizes and lengths at each of the following offices—Universal Engineering Sales Co., 1060 Broad St., Newark 2, New Jersey; 5035 Sixth Ave., Kenosha, Wis., and at our home office in Frankenmuth. Contact the nearest office for immediate delivery.

The Universal Drill Bushing Slide Chart gives accurate engineering data for the selection of all types and sizes of drill jig bushings up to 1¾" drill size. You may have one—free—by requesting on your company letterhead. At the same time, get your copy of our new catalog that describes all of UNIVERSAL'S products including chucks, tool holders, boring bars, bushings and index plungers.

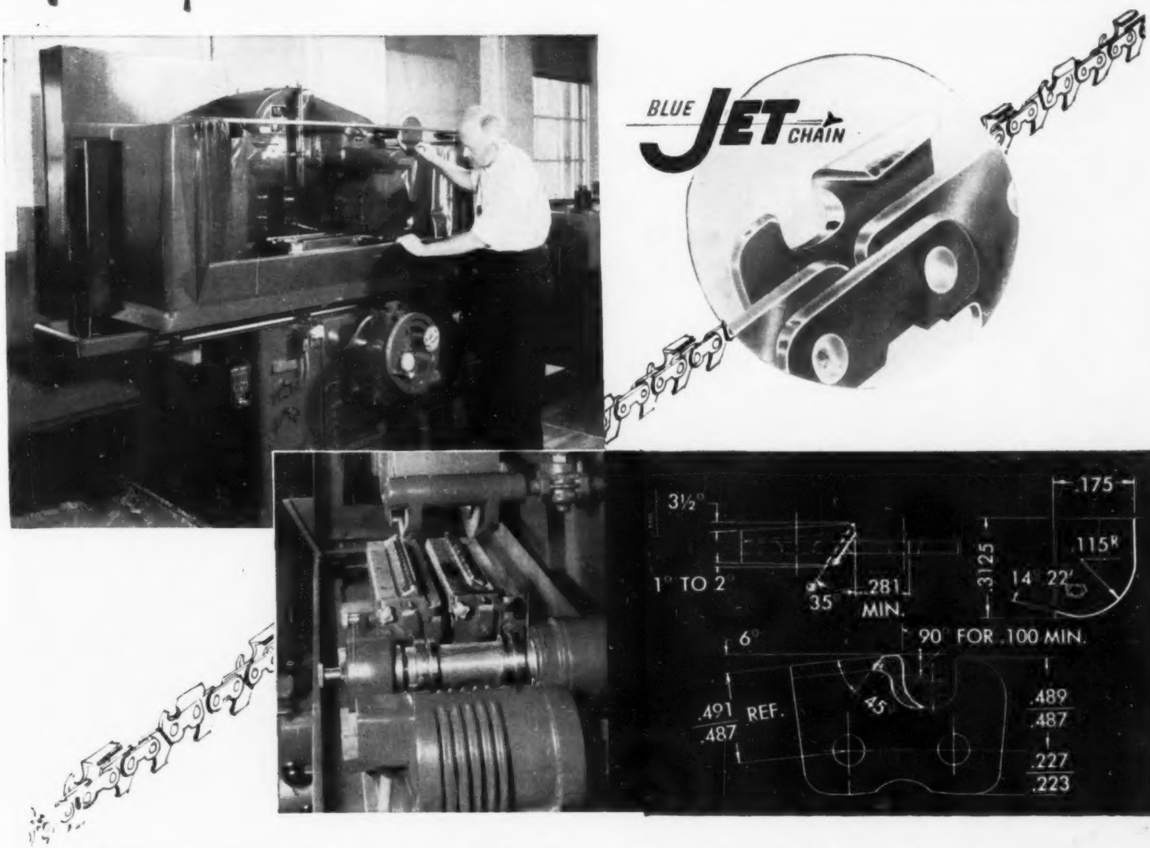



**UNIVERSAL ENGINEERING COMPANY**

FRANKENMUTH 2, MICHIGAN

207

# Thompson TRUFORMING CUTS COSTS 60%




For 140 years, the policy of The Draper Corporation of Hopedale, Mass., has been to offer the highest quality product at the least possible cost.

Following this policy, its subsidiary, BlueJet Corporation, manufacturers of the famous BlueJet saw chain, installed a Thompson Truforming grinder to grind the cutting edges on their chain saw routers. These routers were formerly ground, piece by piece, by a force of 8 employees.

The Thompson Truforming operation is now cutting former grinding costs by 60%. 3 men only are now required for the operation. 40 L.H. and 40 R.H. routers are now ground simultaneously with one pass of the crush formed wheel, resulting in a day's production of over 12,000 pieces—many times that produced by the former method. Both the uniformity and sharpness of the routers have been greatly improved.

For 25 years, Thompson has pioneered and developed the modern advances in crush form grinding. If you have a time-saving, product-improving or cost-cutting problem in your operations, it will pay you to investigate the work Thompson Truforming grinders are now doing in plants all over the country. Our engineering experience is available to you without obligation. Write for Catalog T558.

*"Keep Thompson in mind for the daily grind"*

**THE THOMPSON GRINDER COMPANY**

SPRINGFIELD, OHIO

**SURFACE GRINDERS**



For more data, circle this page number on inquiry card

# STEELWELD SHEAR
## Serves TOUGH JOBS Well

Shearing a ¼" x 6'-0" x 20'-0" steel plate which rides on ball-bearing-capped stanchions. This is a Series 8D-12 Steelweld Pivoted-Blade Shear.

A part of an order of 120,000 gussets cut on the shear.

FOR several years a Steelweld Shear has been in operation at the Drake Steel Supply Co., Los Angeles, California. Most of the time it has been worked on a 16-hour-a-day schedule. It is used for a wide variety of shearing, mostly on 3/16-inch and ½-inch steel plate.

The machine has proven itself on all sorts of shearing jobs. A particularly tough one was the cutting of 120,000 small odd-shaped gusset plates. These were of three sizes and cut three to six at a time of ½-inch steel. The work jarred the shear terrifically, but because of its heavy construction, did not affect it in any way.

Considering the volume of work and hard service, the knives hold up very well. They need be turned only about once every six months.

*Write for free copy of catalog No. 2011*

**STEELWELD**
Mechanical and Hydraulic
**SHEARS** PIVOTED BLADE

Steelweld Machinery includes: Mechanical & Hydraulic Shears and Press Brakes, One-, Two- and Four-Point Straight-Side Presses, Speed-Draw Presses.

THE CLEVELAND CRANE & ENGINEERING COMPANY • 5458 EAST 282nd STREET • WICKLIFFE, OHIO

**Bodine**

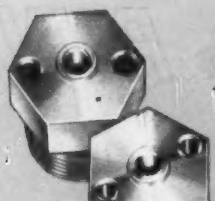
CASE HISTORY No. 49

## showing what ONE versatile Bodine is doing for MANNING, MAXWELL & MOORE, Inc.

**PARTS:**
One is brass, the other tough AISI 347 Stainless Steel.

**OPERATIONS:**
Drill, chamfer and tap (#8-32) two holes 5/16" deep.

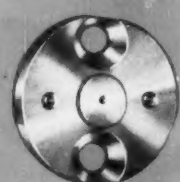
**PRODUCTION:**
Brass, 800/50 min. hour, Stainless, 175/50 min. hour.



**PARTS:**
Brass.

**OPERATIONS:**
Drill and countersink two holes, .173" dia. with .350", 82° countersink. Also drill and tap (#2-56) two holes.

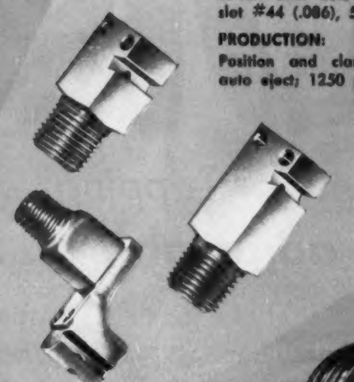
**PRODUCTION:**
1500/50 min. hour.



**PARTS:**
Forged brass gauge-sockets.

**OPERATIONS:**
An unusual feature is two-step drilling of two holes . . . first 1/2-way through, using #37 (.104") half-round drills with bushings; then drill through and chamfer in one operation, using combination half-round drills. By this method tolerances on hole centers are held to ± .001" on the entry and ± .003" on exit side after drilling through 9/16" of stock. Tap same two holes #6-32 9/32" deep. Mill slot .135" (± .002") wide x .156" deep with horizontal milling spindle and 4" saw-type cutter. Drill hole from bottom of milled slot #44 (.086), 5/16" deep.

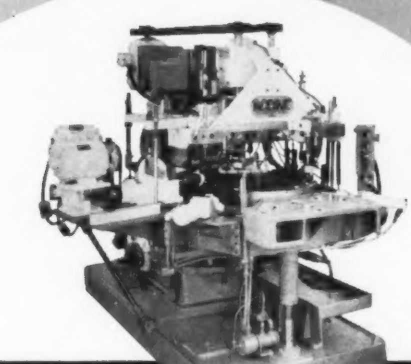
**PRODUCTION:**
Position and clamp; auto unclamp and auto eject; 1250 pieces per 50 min. hour.



**PART:**
Stainless Steel (AISI 347).

**OPERATIONS:**
Drill, chamfer and tap (#2-56) two holes 3/16" deep.

**PRODUCTION:**
150/50 min. hour.



## All these parts and operations on ONE machine with only TWO dial changes!

Here is a good example of Bodine versatility . . . and especially of the ability of a single Bodine Basic Machine to handle exacting jobs of widely differing shapes, sizes, materials and operations . . . with changeover reckoned in minutes rather than hours.

All of these parts are processed with only two dial changes. Spindles, other accessory equipment, and tooling are also basically standardized Bodine units. Retooling for possible future part and operation changes will be relatively simple and inexpensive . . . an important Bodine feature.

Isn't this the kind of time-saving, cost-cutting production engineering you, too, are looking for? If so, do not hestitate to ask us for production analysis of your next job. Write Dept. M-4.

THE **Bodine** CORPORATION
BRIDGEPORT 5, CONNECTICUT

AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

1BD59

**Now you can do <u>both</u> . . .**

# SHORT RUNS

# LONG RUNS

*. . . Drilling and/or Tapping . . .*

## with ONE adjustable U. S. Drill Head

Complete versatility for job shop operations with standard adjustable arms . . . or, equip these heads with U. S. Slip Spindle Plates which are jig-bored for positive alignment to fit the hole pattern. Eliminates trial-and-error in set up.

Double Duty Tools—when your drilling machine has a reversing spindle, you can drill and tap the same hole pattern with one head.

U. S. Drill Heads are fast and rugged—designed and built for profit-making performance. Positive all-gear drive with shaved gears, anti-friction bearings, and oil-tight housings assure smooth and accurate operation.

*Ask for Catalog AD-57, or send specifications of your requirements.*


Slip Spindle Plates may be jig-bored for more than one pattern of holes.

US DRILL HEAD

Adjustable and Fixed Center Multiple Drilling Heads.
Individual Lead Screw Multiple Tapping Heads.

**UNITED STATES DRILL HEAD CO.**

BURNS STREET • CINCINNATI 4, OHIO


**INDEX TABLE SPEEDS TO 80** indexes per minute; carries tooling load up to 200 lbs.; 5, 10 and 15 ton models available; tables fit all press sizes.

# GREATER PRODUCTIVITY FOR PRESS OPERATIONS

Greater productivity is the happy combination of good machine design and effective tooling. The new HPM C-Press, with index table, provides automatic machine operation with hydraulic power and refinements that aid tool engineers in many different ways. Here are three typical operations and what C-Press offers for each.

**SPEED, CAPACITY AND CONTROL FOR AUTOMATIC ASSEMBLY**

Completely adjustable for speed, tonnage and stroke; table has hollow spindle through which air, oil or electrical lines may be piped for assembly needs. Full 16″ work circle for tooling on dial; high speed with high load carrying capacity; anti-friction bearings throughout. Accurate to .002″ with sealed drive unit of barrel-cam design. Complete availability for automatic ejection; large machined mounting pads on sides and throat of press. *More to work with when tooling.*

**SEALED DIAL IDEAL FOR BROACHING JOBS**

Cutting oil cannot contaminate driving mechanism of the table as the table dial is sealed. Provision beneath the ram station for push-through broaching. Smooth, long, adjustable-speed stroke is ideal for small broaching jobs. Index table broaching increases production by eliminating waiting periods for loading and unloading fixtures. *More advantages for broaching with the C-Press.*

**IDEAL CONTROL FOR FORMING AND COMPACTING**

The C-Press provides variable speed and pressure adjustments for compacting loose materials. De-airing during compaction is simplified. Better density control with less laminating results. Metal drawing or forming uses same controlled speed and pressure characteristics for better metal flow, less fracture and improved appearance . . . *it's automatic.*

HPM

**THE HYDRAULIC PRESS MFG. COMPANY**

A Division of Koehring Company
Mount Gilead, Ohio, U.S.A.



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# We make so many sizes . . . your "specials" could be our "standards"

Angular Contact Bearing

Spherical Roller Bearing

Spherical Roller Thrust Bearing

Tyson Tapered Roller Bearing

Single-Row Deep Groove Bearing

Cylindrical Roller Bearing

We regularly produce all of the bearings shown here in a tremendous variety of bores, outside diameters, and widths.

Take just the Tyson tapered roller bearing, for example. We make nearly 1,000 sizes of the single-row, straight bore type alone! Bore sizes range from five-eighths of an inch right up to a precise fourteen inches. And these figures don't include the many other sizes available in our double- and four-row types.

*Yet they are all standard* SKF *bearings,* promptly available in large quantities at competitive prices.

So, why not get full details on the most complete line in the business? Any of our twenty-five sales offices can quote you facts and figures. Just call the one near you.

5921

*Spherical, Cylindrical, Ball, and* Tyson *Tapered Roller Bearings*

EVERY TYPE—EVERY USE

**SKF**®

SKF INDUSTRIES, INC., PHILADELPHIA 32, PA.

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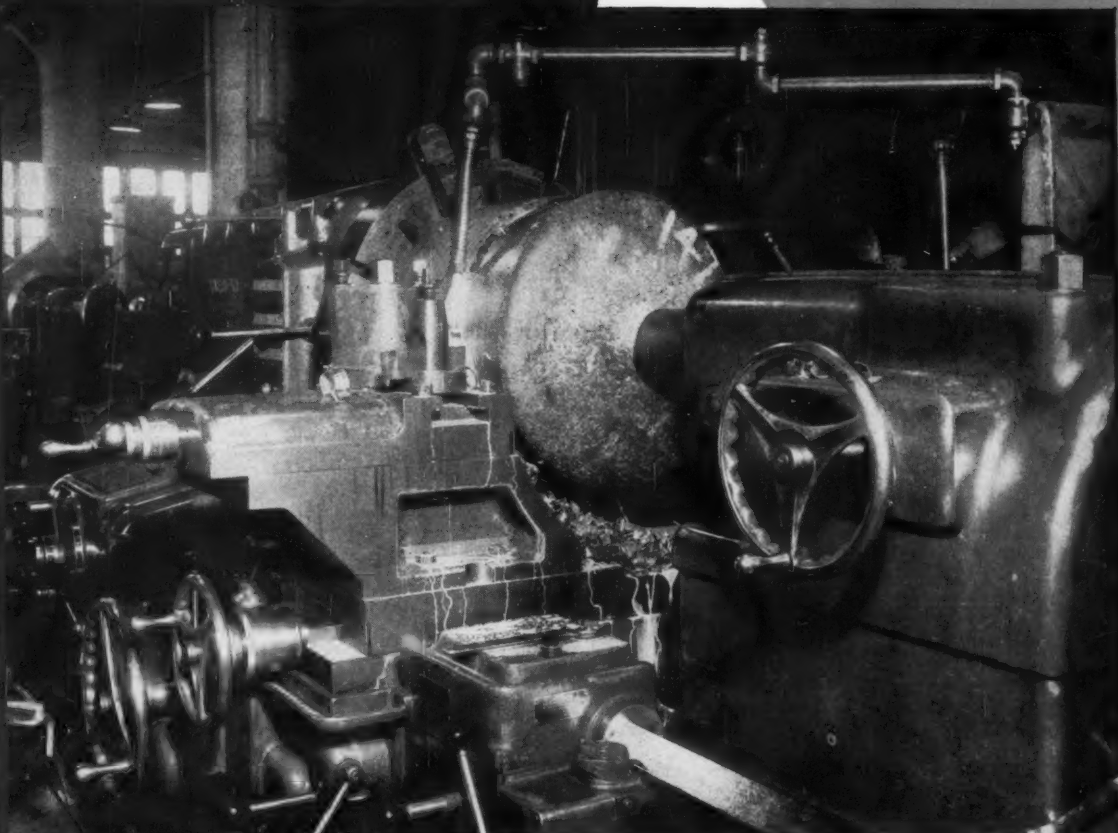


"AMERICAN"

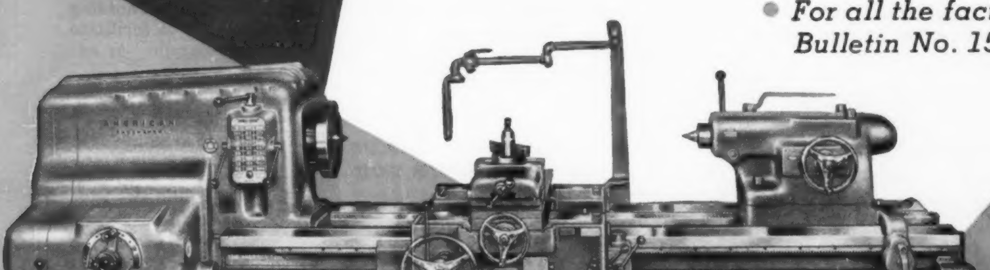
# "Scalping" a $12,000 TITANIUM Ingot...

The operation shown by the accompanying illustration is "scalping" (cutting) the hide off of an ingot of pure titanium sponge. The ingot is 25″ in diameter and the skin or hide that must be turned off is from ½″ to 1″ thick.

Due to the terrific cutting resistance of this "hide" low cutting speeds and exceptional ruggedness and rigidity are essential to satisfactory tool life.

Because power, rigidity, ruggedness and inherent stamina are outstanding characteristics of "American" Pacemaker Lathes they have been selected for this severe service by all of the major titanium fabricators.

- *For all the facts ask for Bulletin No. 150.*



**THE AMERICAN TOOL WORKS CO.** Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

• in vital structural areas of the mighty


Photo courtesy Columbus Division, North American Aviation, Inc.

## the ultra-high-strength alloy steel VASCOJET® 1000

• This is the potent A3J Vigilante, built by North American Aviation for the U. S. Navy—a high-speed carrier based weapon of extreme versatility, requiring the utmost in performance of its critical components. All vital structural parts of this plane were made of VascoJet 1000 because of its ultra-high strength and extreme toughness at temperatures from −100° F. to +1000° F. • Tensile strength of 300,000 pounds per square inch or more is obtainable at mid-radius even in extremely large sections of VascoJet 1000. This steel has the highest strength to weight ratio at temperatures up to 1000° F. of any known engineering material. • Because it does this job so successfully, you are assured of satisfaction in your own critical applications. VascoJet 1000 is used for fasteners, shafts, gears and machine parts as well as in aircraft, missiles and rockets. Send for our detailed twenty-eight page booklet of engineering data and let us discuss, without obligation, your problems where high-strength steel is required.

## Vanadium-Alloys Steel Company

**LATROBE, PENNSYLVANIA**

**DIVISIONS:** Anchor Drawn Steel Co. • Colonial Steel Co. • Metal Forming Corporation • Pittsburgh Tool Steel Wire Co.

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# with LE MAIRE

# STANDARD BUILDING BLOCKS

## Give You Economy . . . Flexibility . . . Simplicity

Before you automate . . . *investigate* the complete LeMaire line of standard hydraulic power units. Each is practical, efficient, economical . . . and nearly as flexible in application as a standard electric motor!

These LeMaire "building blocks" are designed for interchangeable installation on a wide variety of standard bases. This allows low-cost unitized construction, in minimum lead time, of a "special" which solves *today's* production machining problem . . . and which can be economically converted or modified to meet *future* needs.

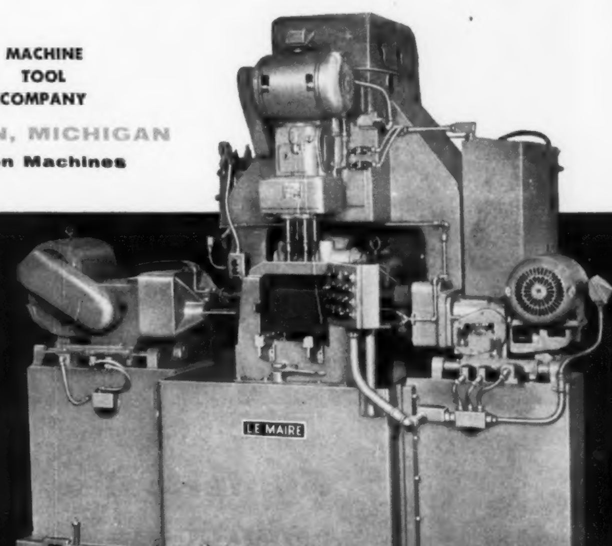
LeMaire standard units are suitable for drilling, boring, counterboring, reaming, spot-facing, tapping and milling. They operate in horizontal, vertical or angular positions. Infinite control of feeds is provided, along with construction which assures twist-free, straight line, uniform operation under all production conditions. All units are built to J.I.C. standards.

For practical, economical, flexible automation, check the possibility of using LeMaire "do-it-yourself" building blocks . . . or ask LeMaire engineers to recommend the right combination for your specific production machining problem. Send parts or prints for prompt recommendations.

**LE MAIRE** MACHINE TOOL COMPANY

2657 S. TELEGRAPH ROAD • DEARBORN, MICHIGAN

**Designers and Builders of Special High-Production Machines**

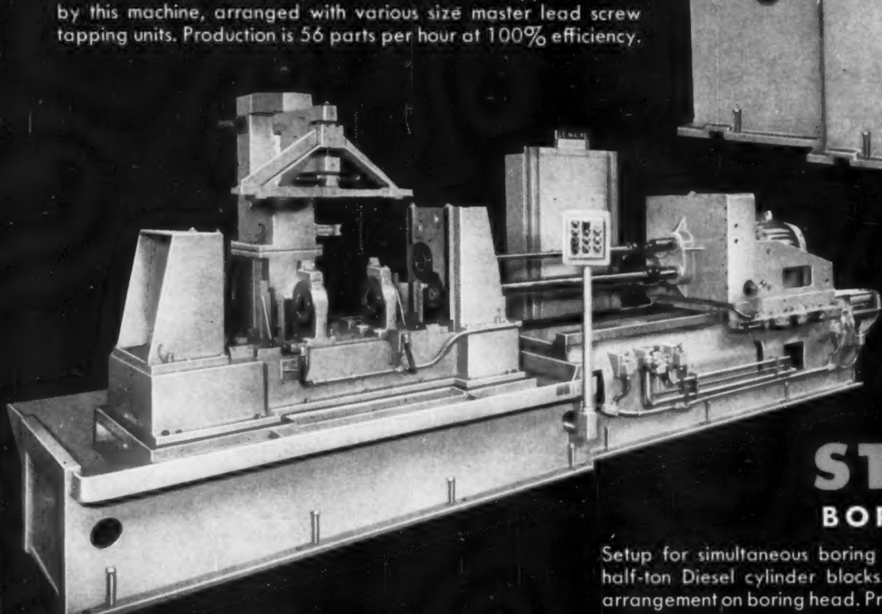



LE MAIRE

## STANDARD

### LEAD SCREW TAPPING UNITS

Four sides of farm tractor hydraulic reservoir are tapped at once by this machine, arranged with various size master lead screw tapping units. Production is 56 parts per hour at 100% efficiency.



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## STANDARD

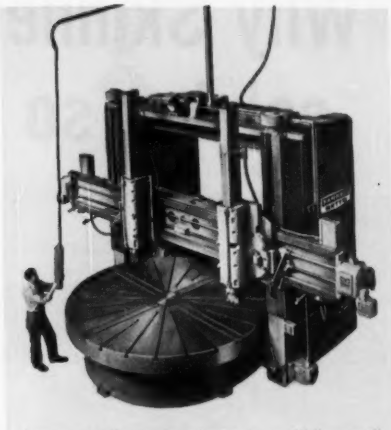
### BORING HEAD UNITS

Setup for simultaneous boring of camshaft and crankshaft bores in half-ton Diesel cylinder blocks. Way type unit has tool positioning arrangement on boring head. Production is 9.4 cylinder blocks per hour.

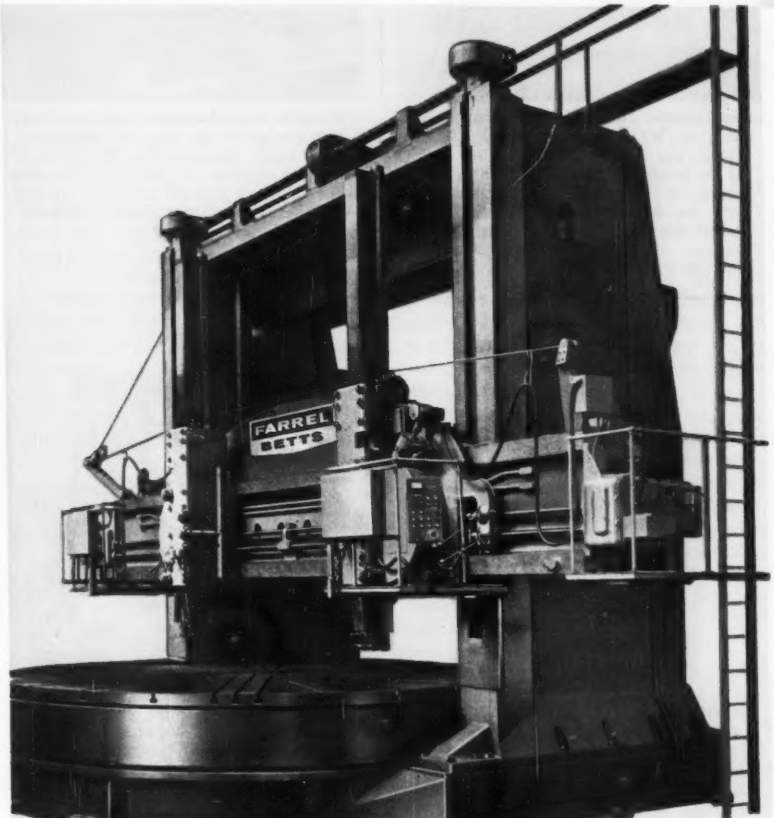
# standard vertical boring mills from

# 100" to 504"

## tailored to individual requirements



Accuracy plus convenience in a 12-foot mill.




Farrel-Betts 20-foot vertical boring mill.

When you select a vertical boring mill from industry's most complete range of sizes, you get the design features needed to meet today's most exacting production requirements.

The Farrel-Betts standard line gives you the latest designs in controls, drives, speed and feed ranges, arrangement of heads, and auxiliary equipment, including taper and tracer attachments, etc., to meet almost any production requirement. Furthermore, features such as antifriction-bearing tables and replaceable bronze liners for the steel rams assure the accuracy and rigidity necessary for finest results.

Contact Consolidated and see for yourself the many advantages of Farrel-Betts mills. Available in sizes from 100 inches to 42 feet and larger.

**FARREL-BIRMINGHAM COMPANY, INC.**
**CONSOLIDATED MACHINE TOOL DIVISION**
565 Blossom Road, Rochester 10, N. Y.
Telephone: BUtler 8-4600
*Plants:* Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.

CM-42

FARREL
BETTS
®



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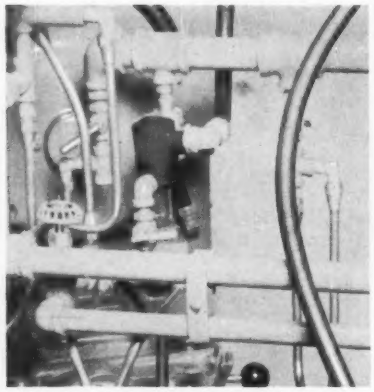
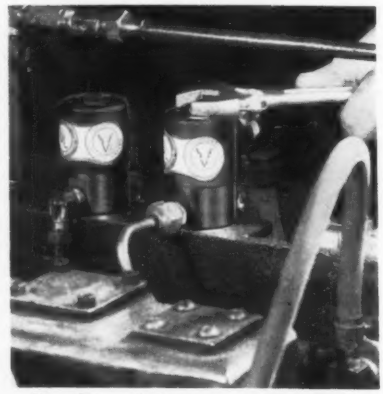
# Why Skinner V5 solenoid valves are solving so many control problems

**Application:** The Leland-Gifford nine-unit hydraulic drilling machine used for drilling crankshafts uses two-way Skinner V5 valves to control the flow of coolant at each operating station of the fixture.

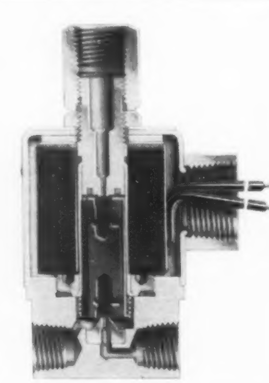


**Automatic coolant operation:** The Skinner V5 2-way normally closed valves are wired so that at the start of the drilling operation the valves are energized causing coolant to flow before the drill starts its drilling pass. When the cycle is complete the drill retracts, the valves are de-energized and the flow of coolant is halted.



**Simple maintenance and repair:** The design of Skinner V5 valves permits hand disassembly for cleaning without removal of the valve from the line. Coils, housings, plungers, sleeves are interchangeable and easily replaced.

**Skinner stainless steel V5 valves** are offered in two- and three-way construction, normally open, normally closed, directional control, multi-directional, quick exhaust. Orifices: 1/32" to 3/8"; NPT ports: 1/8", 1/4", and 3/8"; pressure ratings: to 3000 psi. Explosionproof models UL approved for both Class 1, Group D and Class 2, Groups F and G are available.



**Engineered to highest UL standards:** Body and internal parts of *frequently copied* V5 valve are stainless steel and, thus, corrosion-resistant. Durable, compressible inserts of soft synthetic materials insure bubbletight operation. Orifice seats have radius with well-rounded contact area and high finish for long insert life.

**100% tested.** Prior to shipment, every V5 valve is tested for both internal and external leakage under full pressure conditions with modern, sensitive detecting equipment. In these laboratory tests Skinner V5 valves regularly get over 20-million cycles without leakage. And these results are constantly proving out in service.

*Skinner solenoid valves are distributed nationally.*

For complete information, contact a Skinner Representative listed in the Yellow Pages or write us at Dept. 554

SKINNER ELECTRIC VALVES

THE CREST OF QUALITY

**SKINNER ELECTRIC VALVE DIVISION** NEW BRITAIN CONNECTICUT
105 EDGEWOOD AVENUE

- Favorable Atmosphere a Triple Objective
- Procurement Procedures to be Studied
- Industrial Heating Picture Clearing
- Washington Briefs

# Keeping up with Washington

**Loring F. Overman**

CONGRESS is being asked by the capital-goods industries to consider legislative approaches to three current problems . . . depreciation, import-export policies, and procurement procedures. MAPI (Machinery and Allied Products Institute) continues to take a leading part in focussing industry attention upon pending legislation—particularly that involving the first two objectives.

Hoping to encourage a tax-depreciation policy productive of greater health for both the users and suppliers of capital goods, MAPI has been conducting a series of "Business Investment Policy" conferences in major cities. Published studies provide businessmen with a basis for sound investment decisions, as well as a means of passing the word along to members of Congress. One of these is "Business Investment Policy," by George Terborgh.

Another MAPI division—the International Operations Council—met in New York City March 3-4 to discuss the export-import outlook. Delegates expressed interests in the viewpoints of Representative Boggs (D-La.), chairman of the Ways and Means Foreign Trade Policy Subcommittee. Rep. Boggs' position is that tax incentive measures for private foreign investment must be given the highest priority in 1959. He stated, "We cannot afford to delay in reforming our tax system so as to provide proper incentives to expansion of foreign business activities by United States firms."

## Procurement Procedures to be Investigated

The 40-plus billion-dollar defense program continues to pique Congressional curiosity concerning how the money is being spent. The Senate Small-Business Committee, approving a heavy schedule of hearings and investigations for 1959, included several topics of interest to capital-goods people. In the field of Government procurement:

1. **Sub-contracting to be studied.** Interest centers around sub-contracting in relation to the use of the weapons-system method of procurement.

2. **Small-business problem areas.** Conditions in the small business field of Defense Department procurement are in line for special scrutiny.

3. **Government-owned production equipment.** The Sub-Committee on Relations of Business with Government will study the problem of competitive advantages, if any, accruing to companies holding government-owned machine tools. The committee will also investigate replacement programs of the machine tool reserve, and the ability of machine tool builders to meet future emergencies.

## Industrial Heating Picture Clearing

Grouping of industrial heating equipment definitions, problems, and programs under one heading within the Metalworking Equipment Division of the Business and Defense Services Administration is proceeding rapidly. The work is being directed by James H. Sands, adviser to Niels A. Olsen, director of the division.

Upon his arrival in Washington late last year, Mr. Sands found industrial heating equipment classified under many names, and with jurisdiction scattered over several BDSA departments. Consolidation has been effected and the industry has been assigned a well-defined place in the mobilization pattern.

Changes in the weapons schedule "may develop some critical mobilization heating problems," according to Mr. Sands. "A project under way might have considerable impact on the industry. We are watching the project closely and will alert the industry as early as possible so that the project will receive the most effective assistance the industry can contribute."

"After we review and analyze the mobilization requirements of the military services and defense-supporting industries," he continued, "we will be in a position to determine the critical mobilization areas of the industry. We will then reconstitute the Industry Advisory Committee and ask the committee to meet with us in Washington to review findings and conclusions. Industrial heating programs being developed by the division are of vital importance to the nation's security and to the welfare of the industry."

## Washington Briefs

Industrial output was up for the ninth straight month in January. Advance was one point, to 143 per cent of the 1947-49 average, and only 2 per cent under pre-recession peak of mid-'57.

Despite defeats in the past, Rep. Herlong (D-Fla.) is again pressing for passage of a five-year tax-reduction program sponsored jointly with Rep. Baker (R-Tenn.). The bills are HR 300 and HR 301. During these five years the top rates of individual and corporate income taxes would be cut to 47 per cent each. Other individual rates would be cut accordingly. In addition, the bills would liberalize depreciation write-offs, postpone capital-gains taxes until the taxpayer "disinvested," and trim estate and gift taxes.

Defense Cataloguing had involved 3,425,191 active items of supply by December 31, 1958, Congress has been told. During the last six months of 1958, a total of 198,000 items were added; 254,000 were deleted.

The report to Congress pointed out that development of uniform codes for industrial production equipment is "proceeding on schedule," with 1500 manufacturers supplying information which was coded for inclusion in directories to be published.

**Machinery**
**APRIL 1959**

# *Business Gets a Publicity Break*

INDUSTRIALISTS for many years have been far too inarticulate in warding off the arrows of unjust criticism that have been directed toward them by various facets of our economy. Business men are too complacent if they feel that unfair barbs do them no harm. They should not assume the attitude that the general public will necessarily be able to distinguish between self-interested propaganda and fact.

Up until about the time of the First World War, business men were vulnerable in their relations with labor, and sometimes with the public. Working hours were as long as twelve hours per day, six days a week. Profits were often greatly out of proportion to salaries and wages. So-called "robber barons" bilked their stockholders. Conditions of that sort cannot exist today under the vigilant eyes of the Government, under the heavy income taxes imposed on profits, and because of the watchful attention of aggressive labor unions. Besides, the average business man of today observes higher ethics of operation.

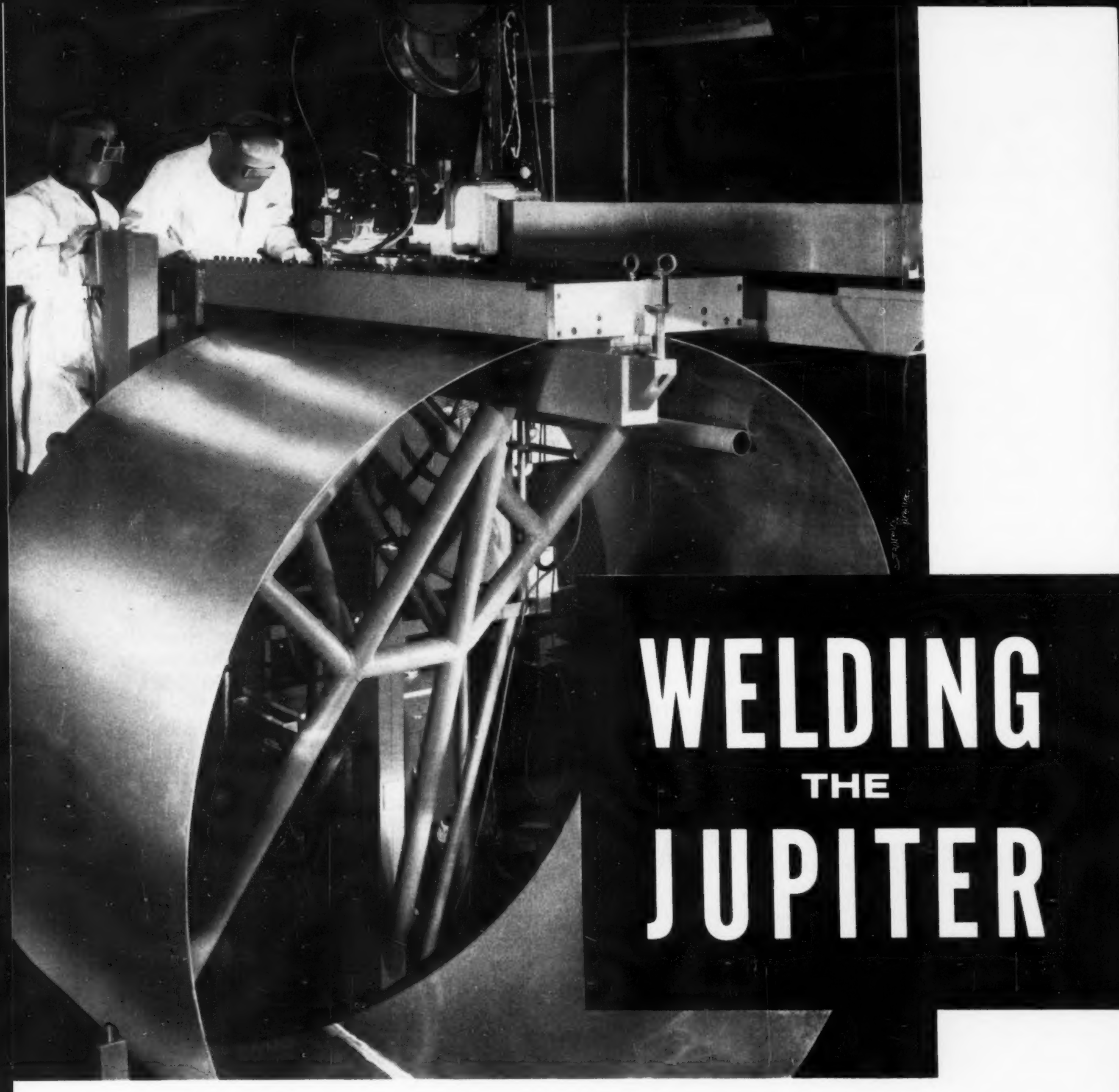
Cartoons appear currently in certain magazines and newspapers that depict business as a bloated autocrat with a black cutaway coat, fancy vest decorated with a heavy gold watch chain, striped trousers, and high silk hat. These cartoons may be considered amusing, but they are as out-of-date as the Diamond Jim Brady attire. Unfortunately, they can have an insidious effect on employe-management relations.

Another unfair practice of propaganda papers is to publish misleading information concerning corporate profits. Seldom are such figures given *after* heavy taxes have been deducted. The published figures are not the actual profits at all!

*Look* Magazine is therefore to be congratulated on an educational program that it has inaugurated to define the role of American business to its readers. It urges businessmen to speak up against unwarranted attacks on this necessary branch of our economy. The magazine aims to emphasize the past achievements of industrial management and to point out the future contributions that industry can make, if allowed to.

Our economy at home, our stature abroad, our race to the stars and beyond are some of the challenges our nation faces today, avers the publisher of *Look*. "And yet," he states, "some people are asking us to meet these challenges with one arm tied behind our backs—the strong right arm of American business." In too many cases, opinions about business are founded on misinformation and half-truths.

Charles O. Herb
EDITOR



# WELDING THE JUPITER

**Mig, Tig, and resistance methods are used in longitudinal, circumferential, and spot welding of aluminum-alloy components for the fuel-tank container sections of this intermediate-range ballistic missile.**

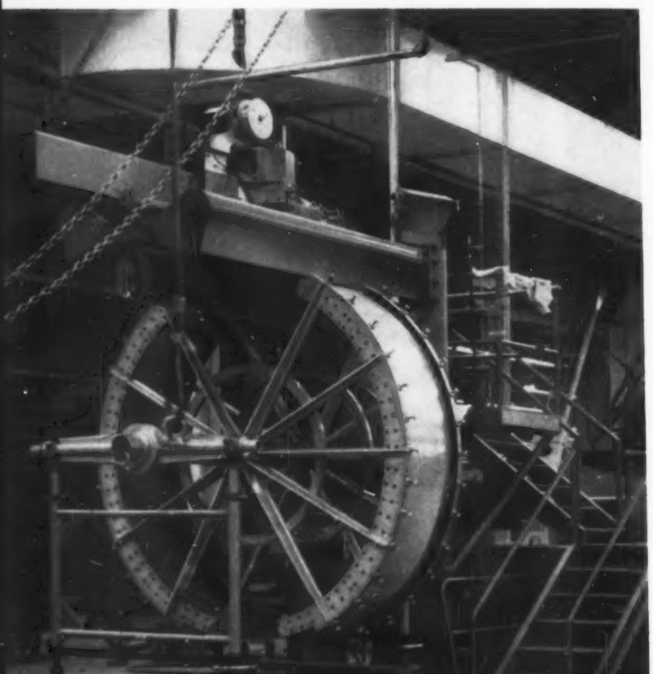
THE MISSILE DIVISION of Chrysler Corporation has been associated with the Redstone missile program since 1952, and with the Jupiter program since 1956, in development, engineering, and production capacities. The Redstone, a 69-foot-long by 6-foot diameter medium-range weapon, was originally developed by the Army Ballistic Missile Agency, Huntsville, Ala., and served as the basis for the Jupiter—a larger, improved version of the surface-to-surface, 1500-mile-range ballistic missile.

More than 2500 suppliers are providing materials, components, and services for Chrysler's missile program. As many as 300,000 parts are combined to form a single missile. Production and assembly are under way in a government-owned

Michigan Ordnance Missile Plant at 16 Mile and Van Dyke Roads in Warren (Sterling Township), Mich., north of Detroit. In spite of the low-volume requirements at present, an attempt has been made to set up the production facilities along automotive lines with respect to flow of materials, manufacturing techniques, and quality-control practices. One of the most striking areas in the plant is the one devoted to the fabrication of the center section, which will be described in this article.

Center sections for the Jupiter missiles measure 105 inches in diameter by 29 feet long, and are made up of seven longitudinal barrel members or cans—five of the barrels being 56 inches long, one 24 inches long, and one 44 inches long. All of the barrels are made from AA5086 wrought, non-heat-treatable, aluminum-alloy sheets containing 4 per cent magnesium, 0.45 per cent manganese, 0.1 per cent chromium, and the balance aluminum. The sheets are purchased strain-hardened and stabilized, with a 1/2 hard temper (H34 condition). Six of the barrels are made from

Fig. 1. Longitudinal butt welding of sheets into barrel sections. Edges of sheets are clamped to backup bar by air-operated pivoting fingers.



sheets 0.091 inch thick, and the seventh, 0.125 inch thick. However, the thinner sheets are milled by the supplier to a thickness of 0.041 inch in specified areas to reduce their weight.

Incoming sheets are carefully inspected to detect surface defects, and samples from each lot are chemically analyzed. Satisfactory sheets are trimmed to a developed length on an Ekstrom Carlson router, and two sheets are used for each barrel in the missile center section. The trimmed sheets are chemically cleaned, degreased, and rinsed. Sharp corners on the square edges of the trimmed sheets are shaved with a scraping tool.

An 18-inch-long section at one end of each sheet is curled on a roll forming machine, and two of the sheets are placed in a cylindrical fixture. The loaded fixture is mounted on the Multi-Hydromatic welding machine, Fig. 1, for joining the abutting edges of the sheets. This longitudinal, butt-welding operation is done with the Tig (tungsten inert gas) shielded-arc welding process—the machine being equipped with a Linde Heliarc head. A non-consumable tungsten electrode, pure argon inert gas, and 1/16-inch diameter, shaved, aluminum-alloy filler wire (53S) are employed.

Since flux is not required, the risk of inclusions is minimized and there is no spatter to clean. The arc breaks up the oxide film, and the inert gas shields the base metal from further oxidation. Welding is done with a current of 20 volts and 190 amperes, with a wire feed of 52 inches per minute. The carriage on which the welding head is mounted is fed at the rate of 23 inches per minute. Only one pass is required and a smooth, uniform-size bead is obtained.

Edges of the sheets to be welded rest on a copper backup bar that is grooved (0.040-inch radius) to accommodate the bead. Multiple fingers clamp the sheets to the backup bar during welding, with the fingers being pivoted into position by means of fire hoses carrying compressed air. Each finger exerts a pressure of about 200 pounds. When one butt weld has been completed, the work-holding fixture is indexed 180 degrees and the other edges of the sheets are joined. A similar setup with Airco welding equipment is seen in the heading illustration.

Bulkheads are installed in the bores of first, third, and seventh barrels, while Z-shaped-ring reinforcements are applied in the remaining barrels of each center section. The Z-rings are made from 0.091-inch thick, 61T6 aluminum alloy, and provided with lightening holes. These rings are joined to the barrels on the Sciaky spot-welding machines seen in Fig. 2.

Spot welds, 5/8 inch in diameter, are made at 1-inch intervals around the periphery of each barrel on this 200-kva machine, with an interval

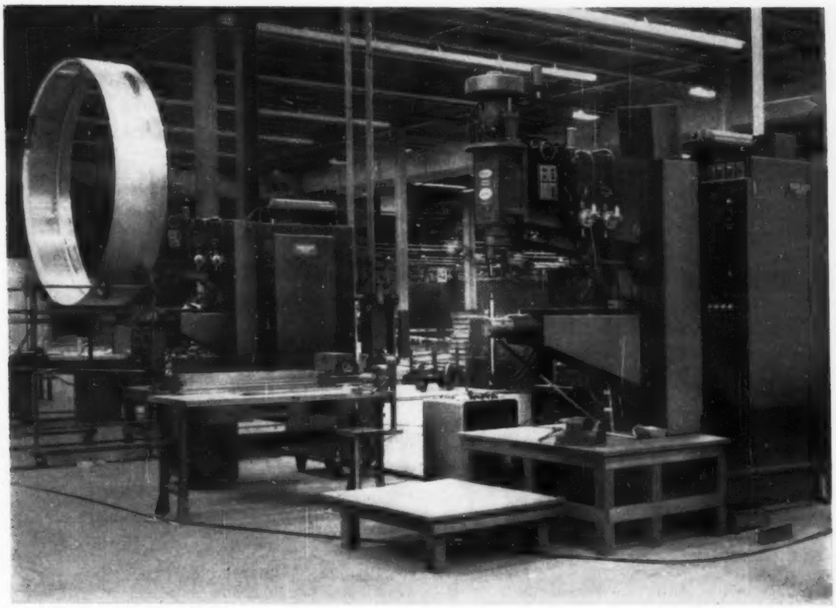


Fig. 2. Z-shaped reinforcement rings are spot-welded to the barrels in this setup. The welds are 5/8 inch in diameter and spaced 1 inch apart.

of ten seconds between welds. The work is positioned by means of a plunger and index-plate. Precise control of the welding, forging, and holding times is accomplished with a Dekatron cold-cathode type of electronic tube which actually counts the cycles of the supply current frequency.

Conical-shaped bulkheads and knuckles are assembled into the barrels on the fixture shown at the left in Fig. 3. The bulkheads are inserted in a spider arrangement, and this assembly is loaded into the barrel. When the hand-operated screw is actuated, the bulkhead is pulled down into the barrel. A maximum clearance of 0.060 inch is provided between the outer periphery of the bulkhead and the bore of the barrel, and the axial location of the bulkhead with respect to the barrel is carefully controlled.

When the bulkhead is in position, it is expanded against the barrel by turning screws on the spider. Then, the assembly is manually welded in place. Circumferential welding of the bulkheads to the knuckles is done automatically with the Mig (metal inert gas) process. This method differs from the Tig process used for

Fig. 3. Bulkheads, mounted in spider, are pulled down into barrels on fixture seen at left. When in position, the bulkhead is expanded against barrel by turning screws.

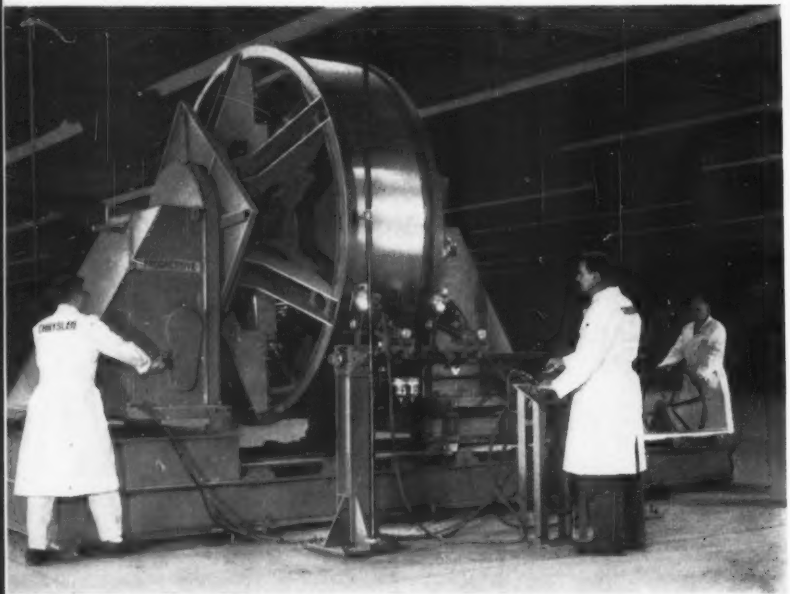


Fig. 4. About 1/2 inch of stock is removed from each end of the barrel in this routing operation. The high-speed steel, single-flute routing tools are rotated at 22,000 rpm.

longitudinal welding of the barrels in that a continuously fed consumable electrode—in this instance 1/16-inch diameter, 56S aluminum-alloy wire—is employed. This wire carries the welding current, and an arc is maintained between the end of the wire and the work. Argon, fed at the rate of 45 cubic feet per hour, is again used for the inert-gas shield. In circumferential welding of 0.156-inch-thick knuckles to 0.156-inch-thick cones, a current of 25 volts and 210 amperes is employed, and welding is performed at the rate of 35 inches per minute. A Linde Sigma welding head is mounted on a Lewis boom carriage for this operation. Air-operated shoes hold the work in place in the fixture during welding.

Barrels for the center sections of the Jupiter missile are trimmed to length on a Progressive routing machine, Fig. 4, maintaining the overall length to size within 0.015 inch, and holding the end surfaces true and parallel within 0.003 inch. To hold these tolerances, the work is set up in the machine by means of optical tooling. The barrel is held by means of air-operated expandable shoes—six fitting into each end of the barrel

Fig. 5. Circumferential welding machine employed to join seven barrel sections, thus forming the complete center section of Jupiter missile which holds fuel tanks.

bore. Two Onsrud pneumatic routers are provided to rotate the high-speed steel, single-flute routing tools at 22,000 rpm. About 1/2 inch of stock is removed from each side of the barrel.

The seven longitudinal barrel sections are welded together to form a complete center section for the Jupiter missile on the special Progressive welding machine seen in Fig. 5. This assembly operation consists of six circumferential welds, each about 330 inches long and of 100 per cent penetration. The inner welding beads have a radius of approximately 3/32 inch, and the outer beads, a 1/4-inch radius. Both Mig and Tig processes are employed, with the Mig head performing welding at rates from 22 to 60 inches per minute, and the Tig, from 11 to 40 inches per minute.

This special welder has a base approximately 66 feet long. An Aronson positioner with variable-speed drive is provided on the headstock. The first barrel is located on a spider, mounted on the faceplate of this positioner. The tailstock of the machine is hydraulically power driven for adjusting to any position along the track as additional barrels are added. Turned, ground, and polished shafting is used for the track.

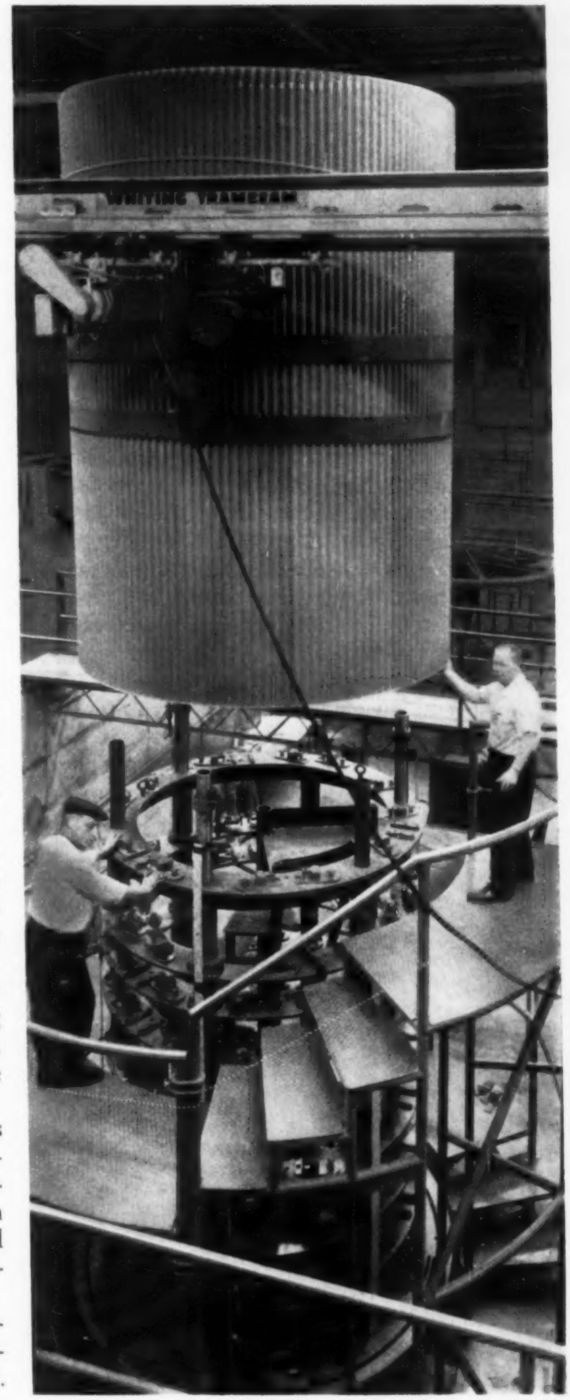
The center spindle of the tailstock is free to rotate, but can be driven with a friction drive when required. This spindle can also be adjusted 5 feet either forward or backward to accommodate backup members necessary because of the variable-length barrels. An expandable spider is provided on the front face of the tailstock to clamp the barrel being welded. Another spider is mounted on the front end of the center spindle. This spider can be expanded to apply pressure on the backup members, or collapsed to permit positioning. All of the units are hydraulically operated.

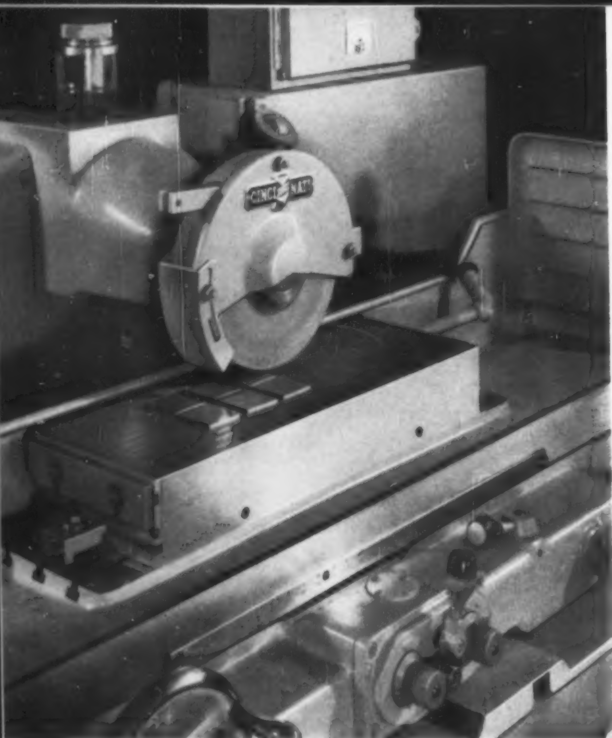
A Linde Heliarc torch and head are mounted at one end of the welding boom, and a Linde Sigma torch, on the opposite end. The boom is mounted on a Lewis column and carriage which permits both vertical and horizontal adjustments. A centrally located console unit is provided for positioning the heads and adjusting the welding current and speed. Power is supplied from a Vickers 400-ampere, direct-current Controlarc welder.

Reliability of welded joints in the missile shells is tested by means of a lightweight, portable X-ray unit that is suspended within the shell. Results of the X-rays are imprinted on strips of film wrapped around the exterior of the missile shell wherever welds are made. The X-ray unit operates on about 125,000 volts.

An outer corrugated skin is riveted to the missile center section in the pit seen in Fig. 6. Optical tooling is employed for accurate alignment.

Fig. 6. Outer corrugated skin is riveted to the center sections while they are mounted in this pit. Optical tooling is used in aligning the missile sections.





# SUCCESSIVE GRINDING CUTS—
# Do They Affect RESIDUAL STRESSES?


L. M. KUBSH

**Member, Research Technical Subcommittee**
**Grinding Wheel Institute**
**and**
**Abrasive Grain Association**


IT HAS LONG been known that any metal will fail from fatigue when it is stressed repeatedly, even though the load applied is less than the maximum stress that the metal can sustain within its elastic limit. This fatigue failure is unpredictable because of a variety of contributing factors. Premature failure can be traced to notches, cracks, corrosion pits, and non-metallic inclusions; to sudden changes in sectional area; and to surface condition.

Fatigue strength is also influenced by residual stresses in the thin surface layer of a part. These stresses can be either beneficial or detrimental to fatigue strength, depending upon whether they are compressive or tensile. They result from manufacturing operations such as heat-treating, machining, peening, tumbling, or grinding. Stresses created in grinding operations in particular are the subject of much discussion.

### *Joint Research Program*

During the past ten years, the Grinding Wheel Institute, through the facilities of the Mellon Institute of Industrial Research, has studied the grinding process, its relation to residual stresses and metallurgical transformations in hardened ball-bearing type steel, and the effect of these changes on the fatigue strength of the steel. Recently, the research program has also had the joint cooperation of the Norton Co. and the Battelle Memorial Institute. It was concluded that grinding, as any chip-forming operation, does contribute to residual stresses, the type and degree of which depend on such variables as wheel grade and condition, grinding fluid, and unit down feed. From the evidence obtained it was further concluded that fatigue strength is not reduced by good commercial grinding practice, and that even under severe grinding conditions, the reduction is only slight.

An important phase of the work in which interesting results were obtained, and with which this paper is concerned, was that of determining whether or not residual stresses were cumulative with successive cuts, and if not, would it be feasible to remove the residual grinding stresses by gradually reducing the unit down feed until spark-out occurred.

### *Measurement of Grinding Stresses*

The presence of surface stresses can be determined from the curvature induced in the material. If as a result of grinding, tensile stresses are created in a piece of shim stock, it will curve so that the ground surface is visibly concave. On the other hand, if the stresses in the ground surface are compressive, the shim stock will warp so that the ground surface is convex. This curvature in a thin piece of metal is extreme because the stresses penetrate through a major thickness of the piece. As the thickness of the metal increases, the curvature becomes less apparent; in thicknesses of 1/4 inch it can be detected only by precision instruments.

For a given cross-sectional area, the degree of curvature is dependent upon the magnitude and composition of the stress. When very thin layers of the stressed material are removed, the metal strip or plate will begin to resume its flat condition. By removing successive thin layers and measuring the corresponding changes in curvature, the depth to which the stresses penetrate can be established. For this work, fatigue bars were prepared which were initially stress-free; thus any changes in surface contour would be caused by the stresses induced in test grinding.

### *Test Procedure and Results*

The steel used in this experiment was oil-hardening tool steel. Changes in shape of the specimens as residual surface stresses were introduced or released were measured by optical interferometry. Experiments were conducted on a horizontal-spindle, reciprocating-table surface grinder, equipped with a vitrified bonded, 46 grit, white aluminum-oxide wheel of medium-grade hardness and structure. Wheel speed was 6000 sfm; traverse speed, 50 fpm; and cross-feed, 0.050 inch after each traverse of the table. Down feed varied according to the procedure of the test. Grinding was done dry. Tests were conducted on fully hardened and fully annealed specimens.

To study the effect of successive cuts on the build-up of residual stresses, six specimens of fully annealed tool steel were placed on the grinder, and a series of passes under the wheel, each 0.001 inch deep, were made. After each complete cross-feed, one specimen was removed from the chuck, which resulted in a series of specimens having from 0.001 to 0.006 inch of stock removed at down feeds of 0.001 inch. This procedure was repeated with six fully hardened tool-steel specimens. The curvature of each specimen was then determined.

### *Stresses from Successive Cuts Not Cumulative*

By plotting the curvature of each specimen against the number of cuts taken from it, Fig. 1, it can be seen that the stresses resulting from successive cuts are *not* cumulative. Because of the lack of slope of the lines, it can be concluded with reasonable certainty that there is no appreciable build-up of stress in the surface by successive cuts of 0.001 inch. It is apparent that there is some fluctuation in the curvatures, but it is outside the experimental error of measurement and exhibits no regular behavior with an increasing number of down feeds. This may be evidence for a continuously changing condition of the cutting surface of the wheel. The fact that

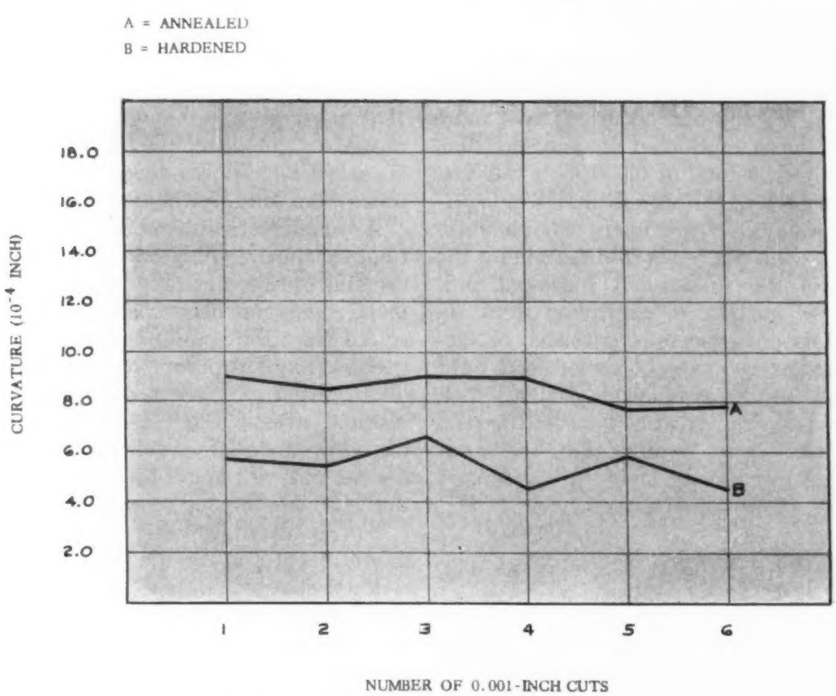



**Fig. 1. The lines show a lack of slope, and thus prove that successive grinding cuts do not produce any build-up of residual stresses in the specimens.**

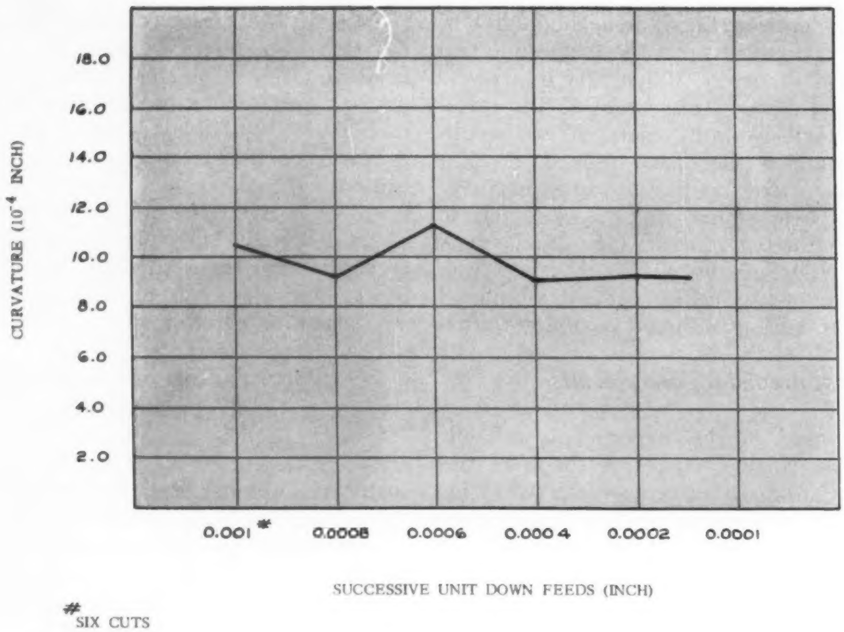



**Fig. 2. Residual stresses do not decrease merely by reducing the down feed rate alone. Test showed that light cuts produced stresses of lower magnitude only when grinding wheel was dressed so as to leave its face open.**

the annealed specimens show greater curvature than the hardened ones indicates that heat-treatment has a marked influence upon the magnitude of the residual stresses.

To determine the feasibility of removing residual stresses by gradually reducing the unit down feed until spark-out occurred, two more grinding tests were conducted on annealed tool steel. In each test, a total of 0.006 inch was first removed from each of the six specimens in 0.001-inch down feeds. One specimen was then removed to serve as a reference in determining the effectiveness of the subsequent spark-out procedure. For the purpose of controlled stock removal, the spark-out procedure consisted of successively reducing the rate of down feed until the final passes were removing only 0.0001 inch of stock. (General shop practice is to let the part finish out without down feeding until the abrasive is no longer removing stock, as evidenced by the absence of grinding sparks.)

### *Curvature Unchanged by Grinding to Spark-Out*

In the first test, down feeds of 0.0008, 0.0006, 0.0004, 0.0002, and 0.0001 inch were employed in that order, and a specimen was removed from the grinder after each complete cross-feed. Fig. 2 shows the plot of the curvature measurements against the down feed. The data indicates that very little change had been effected by the spark-out. Since a down feed of 0.001 inch is known to affect the metal to a depth of approximately 0.006 inch, and since only 0.0021 inch was removed in the spark-out, it was thought that perhaps not enough metal had been removed to get rid of the stresses induced by the six 0.001-inch down feeds to which the specimens were initially subjected.

A second test was conducted in which the total removal during spark-out was 0.0068 inch, with the final cut theoretically penetrating only 0.0006 inch. Again, no major changes in curvature resulted from the spark-out.

Subsequent experimentation on the effect of depth of cut and wheel sharpness on generating residual stresses did prove that very light cuts would produce stresses of lower magnitude than heavier cuts, if the grinding is done with a wheel that has been dressed so as to leave the face open.

To demonstrate the relationship between depth of cut and the magnitude of the resulting residual stresses, six specimens were placed on the chuck of the grinder and shimmed in such a way that each received a slightly different depth of cut for a given pass of the wheel. In this way, all of the specimens were ground simultaneously, making the desired depth of cut on each in a single cross-feed. The wheel was dressed prior to

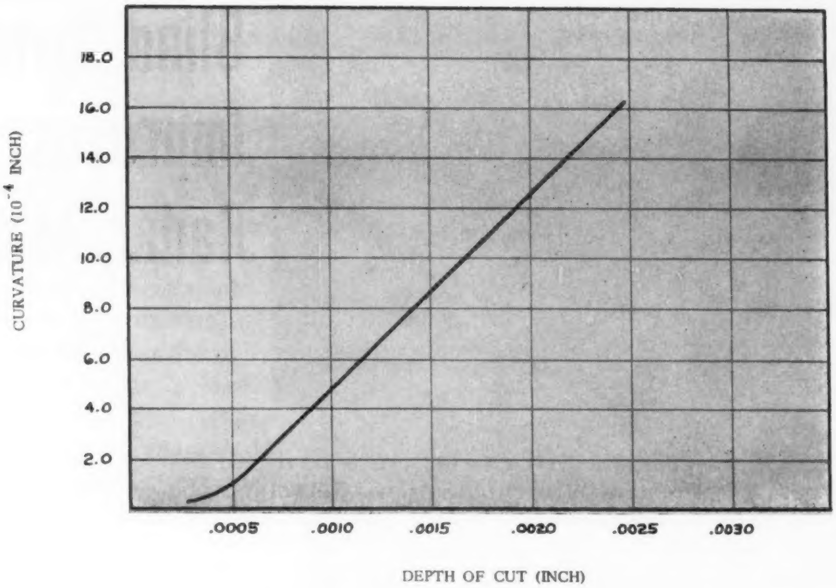



**Fig. 3. In any given grinding cut, the curvature increases in direct relationship to the depth of cut being taken.**

the test. Changes in curvature of the specimens were measured. The effect of depth of cut upon the curvatures of the specimens after the grinding test is shown in Fig. 3. As the depth of cut increased, the curvatures became greater, due to the greater magnitude of the introduced residual stresses.

### *Wheel Dressing Essential for Final Cut*

That the magnitude of residual stresses is dependent on wheel sharpness was shown in still another experiment. A specimen was subjected to six grinding tests. In the first three, there were five complete cross-feeds, with a down feed of 0.001 inch per cross-feed. The other three tests consisted of one complete cross-feed, each with a 0.001-inch down feed. The wheel was dressed to an open face prior to tests one, four, five, and six. This procedure gave the wheel a chance to become dull during the second and third tests. At the end of each test, the change in curvature of the specimen was measured and the resulting stress calculated:

| Test No. | Stress, Pounds per Square Inch |
|---|---|
| 1 | 18,000 |
| 2 | 22,000 |
| 3 | 35,000 |
| 4 | 21,000 |
| 5 | 14,000 |
| 6 | 14,000 |

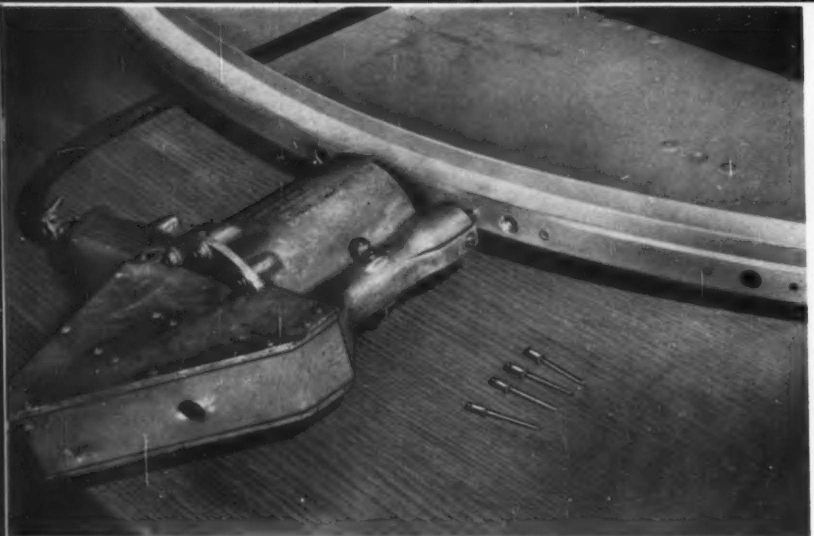
This data shows a continuous increase in the magnitude of the grinding stresses through the first three tests, with a sudden decrease in the fourth test. The stress remained at the lower value after the fifth and sixth tests. The experiment was repeated with five other specimens with similar results.

From the study, three significant conclusions having commercial value can be drawn:

1. The fact that the magnitude of residual stresses does not increase with successive cuts makes it apparent that each pass of the wheel wipes off the effect of the preceding pass. Hence, in cases of heavy stock removal, significant amounts of metal can be removed in a reasonable period of time without inducing extreme residual stresses.

2. Residual surface stresses can be reduced after the main stock removal by properly dressing the wheel face and finishing the part with smaller unit feeds. Spark-out with the wheel in the same condition as during the main stock removal does not reduce the residual grinding stress.

3. When grinding parts where residual stresses, fatigue strength, or distortion are elements of concern, it should be remembered that the unit feed and wheel sharpness play a big role in producing quality parts. In these situations, grinding conditions should not be left to the discretion of the operator but should be specified by those responsible for product quality.



# Blind Riveting Improves Radar Assembly

THE LONG SIDES of a T-nut will prevent turning when the nut is placed in a channel or other confining section. Often, this type of nut is used to reinforce light metal fabrications when their wall thicknesses are insufficient to support tapped holes. If a precision assembly is required, T-nuts are sometimes formed with small tips or ridges and then projection-welded in place. Recently, designers at Raytheon Mfg. Co.'s plant, Waltham, Mass., have both improved the design and speeded the production of reflectors for small-boat radar by blind-riveting a modified T-nut assembly into the frame of these reflectors.

Each reflector consists of three channel-like framing strips, three modified T-nut sub-assemblies, six blind rivets, three bolts, and the outer accurately formed aluminum skin. Once assembled, the reflector is bolted to a pedestal.

The channel frames are pressed from a sheet of 0.046-inch-thick aluminum and formed to suit the curve of the reflector. Holes are punched in two of the three channels to accommodate the T-nuts. These nuts, comprised of a threaded stainless-steel socket swaged into a 3/16-inch thick aluminum strip, are positioned in the recessed web of the channel, aligned with the holes, and blind-riveted in place (Fig. 1). The assembly is shown in section in Fig. 2.

Raytheon selected "POP" Rivets for this job, since they have used them in making military equipment for Dew Line radar. Manufactured by the Pop Rivet Division of United Shoe Machinery Corporation, these rivets are fundamentally blind fasteners. They may, however, be used in any riveting application, especially where access to one side is limited. Each fastener consists of a hollow, heavy-walled rivet through which a mandrel extends. To expand and set the rivet, the mandrel is pulled into the rivet shank with either pliers or a portable power tool. The mandrel is necked and breaks when rivet is set.

A special mold is used to assemble the related parts. The framing is placed in the mold and covered with the exterior skin and an adhesive is applied. The mold is then clamped down and heated. After the unit is removed, tack rivets are set around the periphery of the reflector, which is then mounted on the pedestal using three 1/2-inch bolts secured in the sockets of the T-nuts. The low-head profile of the rivets and the indentations on the cover sheet allow the rivets to be hidden below the outer skin.

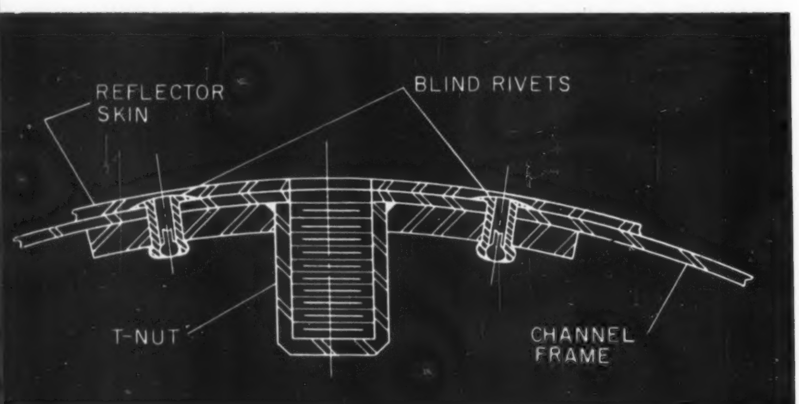
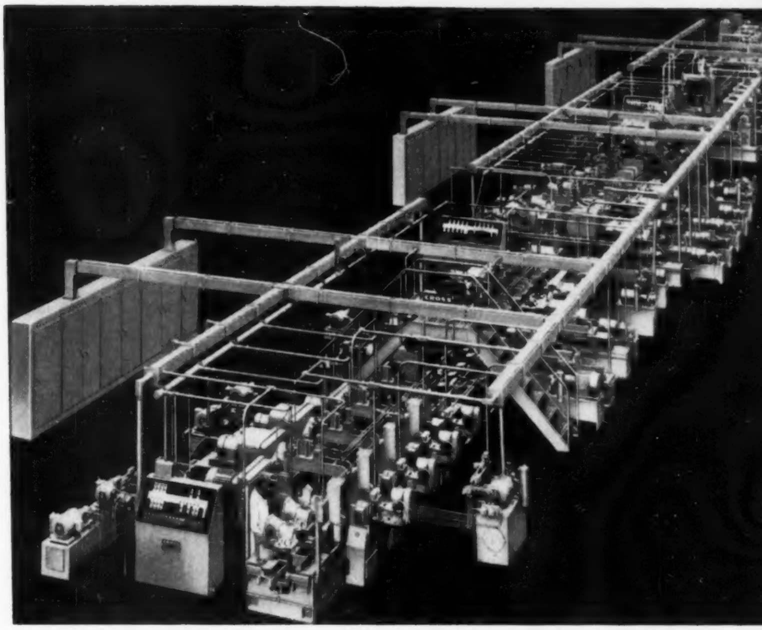



**Fig. 1. (Above) Special T-nuts are fastened in the channel by two rivets set with an automatic hand gun. Although access to both sides is possible, fastening is simplified by the use of blind rivets.**

**Fig. 2. (Left) The reflector skin is indented to accommodate the heads of the rivets. On setting the blind rivet the mandrel breaks, leaving the headed portion in the rivet.**

**Incorporated in Cross Transfermatics for the partial processing of Ford's complete line of four different transmission cases are many new developments in transfer machines. For example, a new method of transferring, locating, and clamping the delicate aluminum parts is used. Electronic tool protectors, static controls, and an integrated maintenance system are other innovations described.**

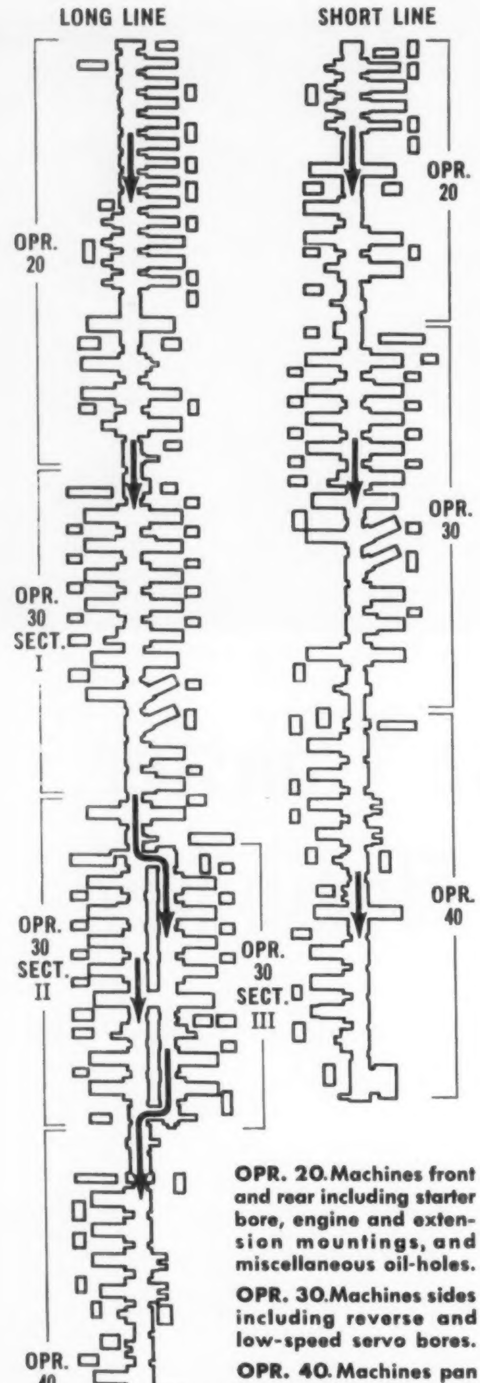


# Multiple-Purpose Transfer Machines Offer Flexibility

EMBODIED in the automotive industry's newest transfer machines for automatic processing of aluminum transmission cases at Ford Motor Co.'s Sharonville, Ohio, plant are a host of innovations which represent a whole new approach to transfer machining methods and design. By significantly reducing floor-space requirements, the investment necessary in work in process, and capital outlay, these new developments hold promise of outdating existing single-purpose transfer machines. One of the "sectionized" Cross Transfermatics employed for drilling, boring, cross-facing, reaming, chamfering, counterboring, and tapping the cases is seen in the heading illustration. In contrast to the single-purpose lines formerly used to process each different design of transmission case, only two Cross lines process Ford's complete product mix of four different cases simultaneously. This mix is made up of the designs required in various quantities for the different engine sizes used in Ford cars. From the standpoint of design, the parts are alike—the differences for the most part are in dimensions in the hole patterns.

The case required in the largest quantity is processed on the so-called "short line" (seen in the heading illustration), while the other three cases (plus overflow requirements for the first case) are processed on the so-called "long line." A floor-plan layout of both lines is seen in Fig. 1. Classified by the three positions in which the cases are transferred and machined, each line is divided into three sections—known as Operations 20, 30, and 40. Operation 20 covers all operations on the front and rear faces, as well as the main bore. Operation 30 covers the side operations, including the servo bores. Operation 40 covers the operations on top, as well as the valve face and the pan face from the bottom.

All cases are presented to Operation 20 with the center hole rough-bored, the faces milled, and the locating holes and the transfer points machined. Movement of the parts through the long line is of particular interest because of the




machine "intelligence" required to process all four different parts simultaneously. Basis for the intelligence is a part-identification boss on each casting shown encircled in the top view of Fig. 2. Sensing units strategically placed along the line contact the identification bosses and initiate head movements, part shuttles, indexing units, etc., to direct the flow of the parts through the line and to select the proper operations.

In Operation 20, the parts move through the machine with the axis of the main bore at right angles to the line of transfer, thus exposing the ends of the cases to the machining units. Operations performed on the front and rear ends of the main bore are the same for all cases. However, operations on the bell housing, Fig. 3, vary from case to case. Provisions have been made to machine three different engine-mounting arrangements on the different bell housings. This is accomplished with three groups of four machining units on the left-hand side of the machine. Here the operations are selected as the parts are clamped in the work-holding fixture, since the sensing units are a part of the clamping devices.

Operation 30 begins with a lateral material movement from the last station of Operation 20. This is accomplished with an automatic, material-handling device that also indexes the part 90 degrees so the main bore is parallel to direction of transfer, Fig. 4. Operation 30 is divided into three sub-sections. In Sub-section I, all operations on the left-hand side of all cases (including the reverse-servo bore) are completed by a group of ten machining units. In addition, a group of seven machining units completes all operations on the right-hand side of the Ford case (including the low-speed servo bore).

Sub-section II, a continuation of Sub-section I, completes all operations on the right-hand sides of the cases (including the servo bores). Sub-section III is an off-line section, running parallel to Sub-section II, for processing the large bell-end cases on their right-hand sides. At the end of Sub-section I, a sensing device identifies the case by size and actuates a material-handling unit which carries the parts directly to Sub-section III. At the end of this sub-section, a similar material-handling unit returns the identified part to the main line. Here they join with all size cases that have moved through Sub-section II.

Next, a material-handling device picks up the parts at the end of Operation 30 and moves them laterally to the loading station of Operation 40. During this transfer, a compound index occurs (in combination with the lateral movement) so that the parts are placed in the loading station with their main bores vertical, the bell housings up, and the pan faces

Fig. 1. Layout of "long" and "short" lines. Long line processes four different designs of transmission cases, while short line is used for high-volume production of one case.

toward the right-hand side. Operation 40 is the same for all parts, with the exception of the angular, inspection-cover holes. Provisions have been made to handle two different covers at Stations 32, 33, 35, and 36. Selection of the proper units is accomplished with a sensing device working with the clamping movement, as was used in Operation 20. At the completion of all operations, the material-handling unit rotates the cases into position for mounting in the cars, and then moves them onto a conveyor.

A new method of transferring, locating, and clamping the delicate aluminum parts is used in both the "long" and "short" line. Formerly, aluminum parts have been moved through transfer machines on work-carrying pallets. This was necessary because it was virtually impossible to maintain the precision of part-locating surfaces and holes after a number of consecutive transferring, locating, and clamping operations.

With the new design, the transfer carrier lifts the part from the approximate locators of one fixture, carries it forward, and then sets it down over the approximate locators of the next adjacent fixture, Fig. 5. The fixture clamp then contacts the part with a light force of 10 to 20 pounds, while the locating pins enter the locating holes. After the locating pins are in place, the full clamping force is applied and the part is ready to be machined. This system eliminates scratching and scuffing of the locating surfaces. Also, the approximate locators align the part with the locating pins so that the pins can enter the locating holes without damaging them. Another advantage is that the part is prevented from tipping while the locating pins are entering the holes by the light clamping force that is applied to the part immediately after it is deposited in the fixture.

Electronic tool protectors are another Cross development in the case lines, Fig. 6. Installed at several points throughout the line where long, small-diameter tools are employed, the new "Protect-O-Tool" consists of a coil which creates a magnetic field that stops oscillating when the tool is present in the coil. When the tool breaks and remains in the work-piece, oscillation resumes and shuts down the machine while simultaneously signaling the location of trouble to the control panel. Even though use of the Protect-O-Tool eliminates the need for separate mechanical probe and inspection stations, its greatest advantage lies in its ability to prevent additional breakage and unnecessary processing of parts that will have to be scrapped.

Several innovations illustrate the emphasis placed on the prevention of unpredictable down time and minimizing of predictable down time. For example, both lines employ Westinghouse

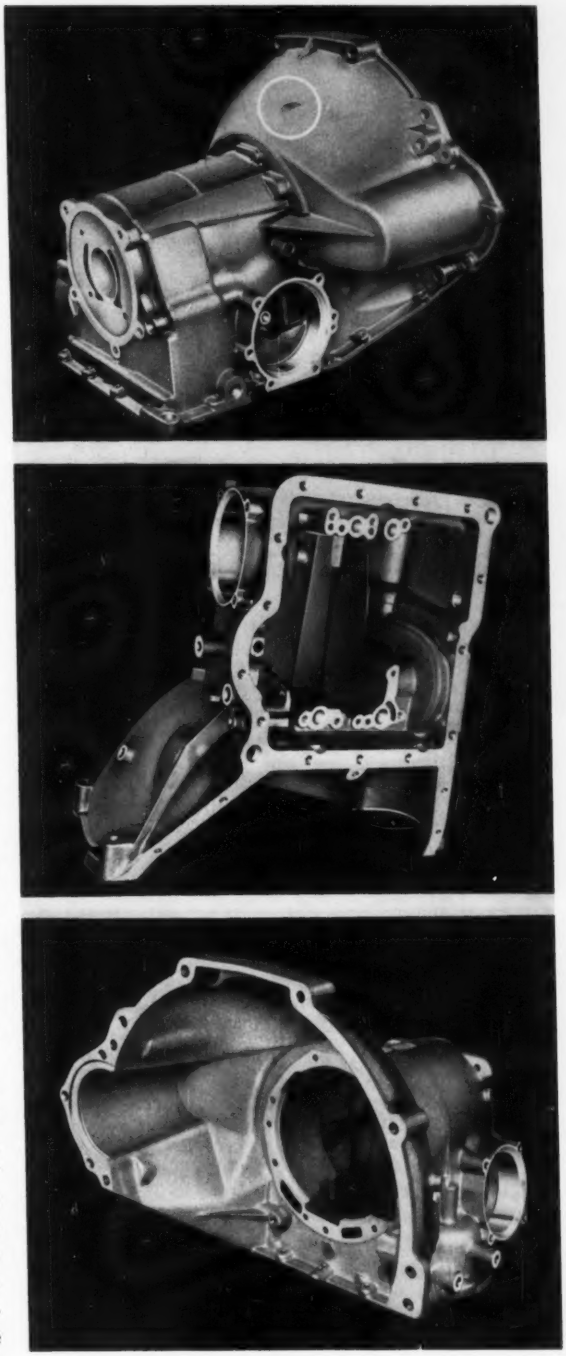


**Fig. 2. Side, bottom, and bell-end views (top to bottom, respectively) of aluminum transmission case. Encircled identification boss (top view) actuates "sensing" devices that direct flow of different parts through the long line.**

units, Fig. 7. In this way, down time is greatly reduced, since any module for a given head can be quickly pulled from the panel and replaced by a new one. Trouble shooting accomplished off the machine does not affect machine efficiency.

Down time for tool changes is minimized by the use of pre-set, quick-change tooling in conjunction with Cross Toolometers and Machine Control Units, which signal the approach of tool-change requirements and shut down the machine or machine section shortly thereafter. By alerting attendants for other maintenance operations through the use of signal lights on the Machine Control Units, all tool changes and minor maintenance are accomplished during the down period.

In this integrated maintenance system, called "The Buddy System," teamwork by operators, tool-setters, and machinery maintenance men is further coordinated by phone jacks installed at convenient points throughout the line. Where only one section is shut down, output is maintained by feeding parts into succeeding sections from banks located at the heads of Operations 20, 30, and 40. During peak production scheduling, tool changes are arranged by operations and by use of banked parts. An output of one transmission case every thirty-one seconds is maintained from the line.

Cypak static controls—representing the industry's largest installation ever to use these controls. By providing switching operations without moving parts, these controls feature optimum operational life and require no servicing except for unpredictable failure.

For simplification of maintenance, electrical panels are organized into modules, with each module controlling one of the machine feeding

The impact of flexible transfer lines on the economic life of such equipment has already been made apparent at the Ford Sharonville plant by a number of changes. One such change just recently completed was the conversion of the "short" line to facilitate processing of more than one case. Since this line was designed anticipating such product changes, the conversion

**Fig. 3. (Above) To achieve the required accuracy and rigidity without distortion, a floating bushing plate equipped with a series of hydraulically actuated clamps is provided for processing the bell end of the transmission case.**

**Fig. 4. (Right) Material-handling device automatically transfers cases laterally from Operation 20 to Operation 30, and indexes each part 90 degrees so that the main bore is parallel to direction of transfer.**

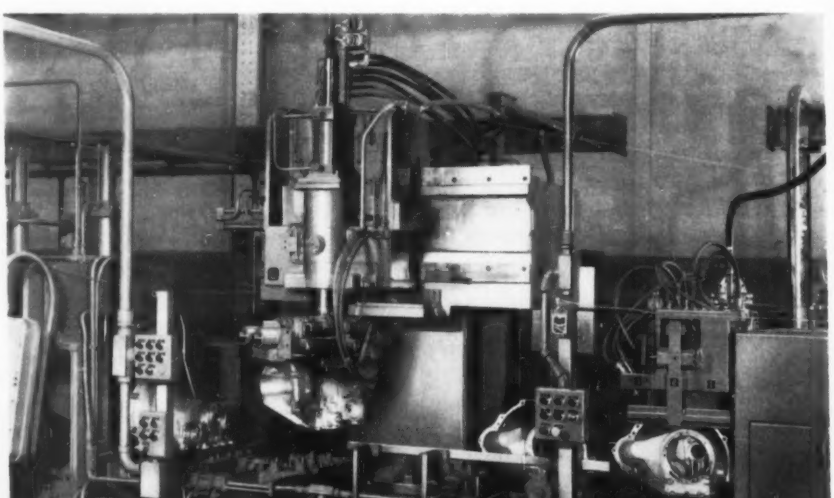
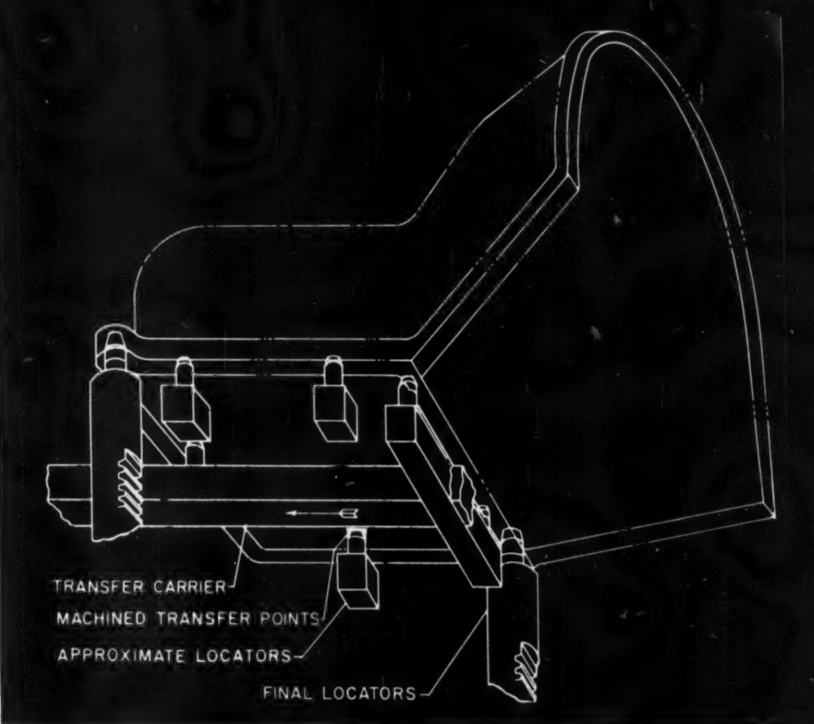


Fig. 5. (Right) To protect the locating surfaces and holes, approximate locators receive parts from the transfer carrier and align them with final locators. A double pressure clamp prevents tipping the light parts when the locating pins enter.

Fig. 6. (Below) Protect-O-Tool consists of a coil creating a magnetic field which detects the presence or absence of a tool. Should the tool break and remain in the hole, the machine is stopped and the panel signaled.



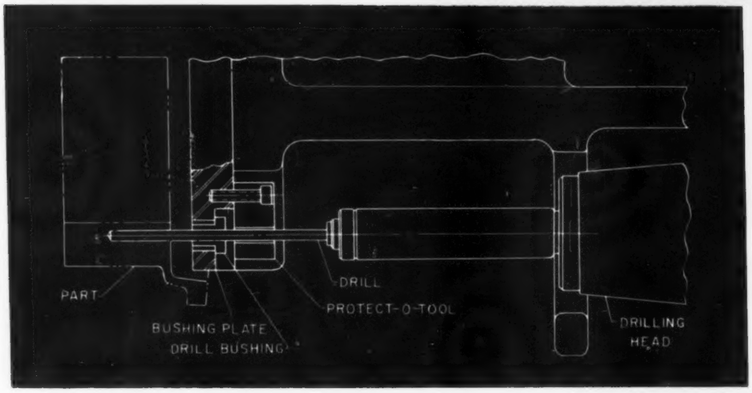
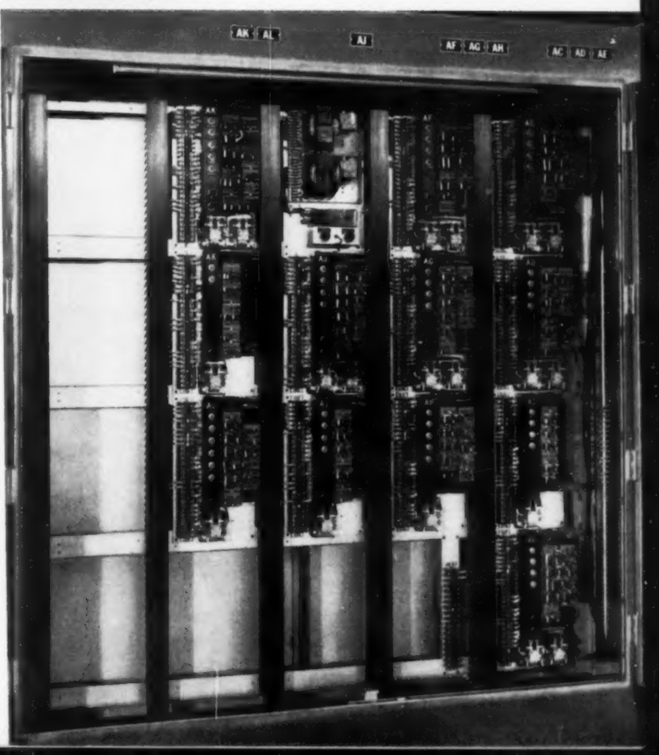




Fig. 7. (Below) Each machine feeding unit is controlled by a modular switching unit in this static control cabinet to facilitate maintenance. Open sections in the cabinet permit future additions or changes, in accordance with the latest JIC standards.

was accomplished quickly and simply by adding sensing units and replacing several heads.

Provision has also been made in the "long" line to handle future design changes and additional products. For example, parallel Sub-sections II and III of Operation 30, which presently employ heads on the outside only, can be separated to allow the addition of up to fourteen more feeding units. In addition, many idle stations in Operations 20 and 40 provide considerable flexibility in processing parts whose design may be changed. Mounting surfaces (including keyways and bolt-mounting holes) at these open stations are completely machined to provide for additions or repositioning of standard building blocks. Except for the special fixtures, part-clamping devices, and multiple-spindle drilling heads, these lines could qualify as standard transfer machines providing unlimited opportunity for future reapplication of all other components that make up these two lines.



# CHEVROLET'S EXHAUST MANIFOLDS ARE SUBMERGED-ARC WELDMENTS

**Fig. 1. Each stem has an integral flange which is submerged-arc-welded to the main tube of the manifold.**

PRODUCTION of exhaust manifolds from steel tubing for Chevrolet cars and trucks involves more problems than casual observation may indicate. Several different shapes (Fig. 1) are required. All have one or two welded T-joints, with all or part of the stem at right angles to the main tube.

The joint end of the stem is a saddle-like flange, oblong in end view. The two long edges of the flange are straight; the other two edges are radiused to fit the outside of the main tube. Part of the processing consists of slipping triangular mounting pieces over the ends of the assemblies. With these in place, the ends are flared in a die.

Tubing for the manifolds is produced from 0.074-inch-thick steel coil, the stock being roll-formed and seam-welded in a continuous operation. Most manifolds are of 2-inch diameter. Several different bent shapes are needed, since manifolds are built for two eight-cylinder engines, and those for trucks differ from those for passenger cars. Also, those vehicles equipped with dual muffler systems require a special manifold design of their own.

Once the tubing has been produced and cut to length, one end of each stem is drawn to the flange shape. Openings are punched in the main tube where the stems are to be welded.

A submerged-arc technique is used for the welding. The two long edges of the flange are welded to the main tube in a straight-line feed of the work under two electrodes. For the two radiused edges, a pair of electrodes feed through guides which remain in a fixed position while the work is rotated in a suitable arc. Resulting welds are sound and strong, and leakers seldom occur. No flash is produced, so there is no interference with gas flow.

One of the battery of National welding machines assigned to this work appears in Fig. 2. It is equipped with two Lincoln Electric submerged-arc heads which lower automatically to position after the work-fixture is locked. A mild-steel electrode wire (Lincoln L-60), 3/32 inch in diameter, feeds in automatically after flux is made to flow around the joint. High frequency assures striking of the arc at the instant the electrodes contact the grounded work.

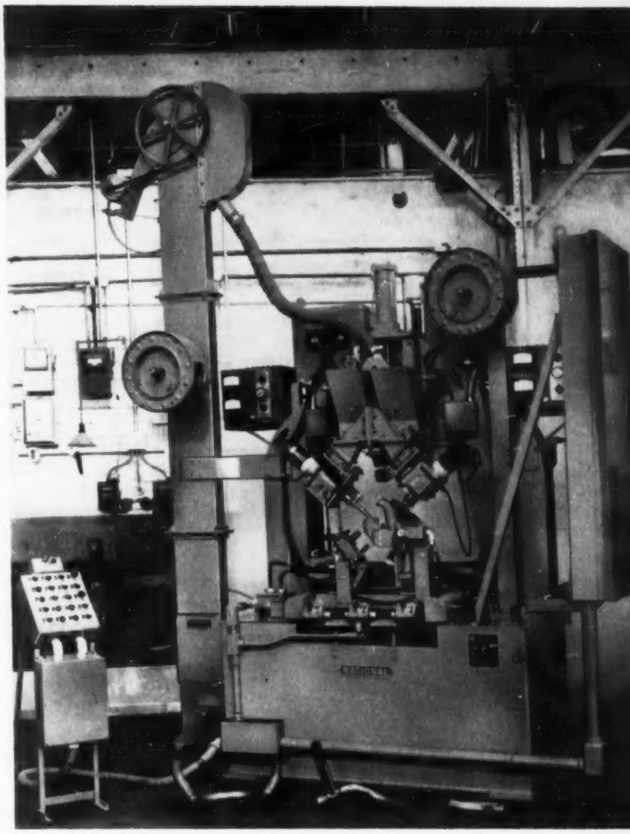
A close-up view of the setup for welding the two long edges of the flange appears in Fig. 3.

The stem, flange end up, is in a vertical position in the fixture, with the main tube extending laterally to the rear. The two welding heads, coming in at an angle, are shown partly lowered. Traverse of the work under the electrodes starts when the electrodes come into contact with it and continues at a uniform rate of 50 ipm (inches per minute) until the two welds are completed.

The electrodes then retract, the heads are elevated, the fixture is unlocked, and the work is ejected into a chute. Excess flux is recovered, screened, and returned by an elevator to hoppers above the welding heads. Any flux remaining on the seams is chipped off so as not to interfere with the subsequent welding of the two radiused edges on another machine.

In that operation, Fig. 4, the work is supported in a fixture which is mounted on trunnions. As soon as the arc is struck, the fixture starts to rotate through an arc of about 175 degrees, completing the pair of welds simultaneously. When the heads retract and the fixture is unlocked, an air-operated unloader grips the weldment, extracting it from the fixture and transferring it to a conveyor. The fixture is then rotated back to its starting position, where it is ready for reloading. Beads have now been laid down around all four edges of the stem's flange.

Two of the manifolds, as Fig. 1 indicates, have two T-joints, so the work is processed through



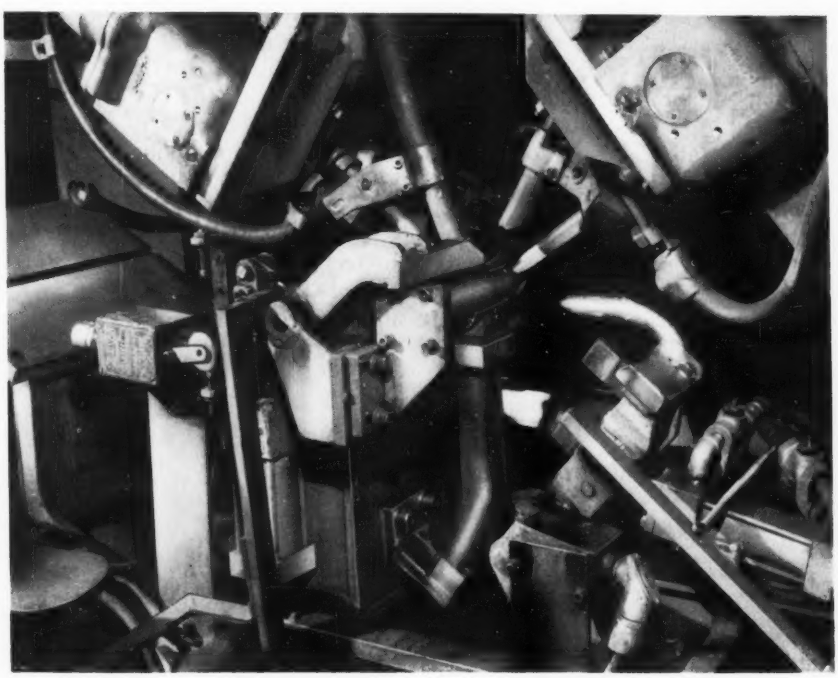


Fig. 2. (Above) This machine makes the two straight-line submerged-arc welds along the manifold's oblong flange. Elevator at left returns flux to hopper.

Fig. 3. (Left) In welding the two straight edges of the flange, the fixture feeds under the electrodes from front to rear.

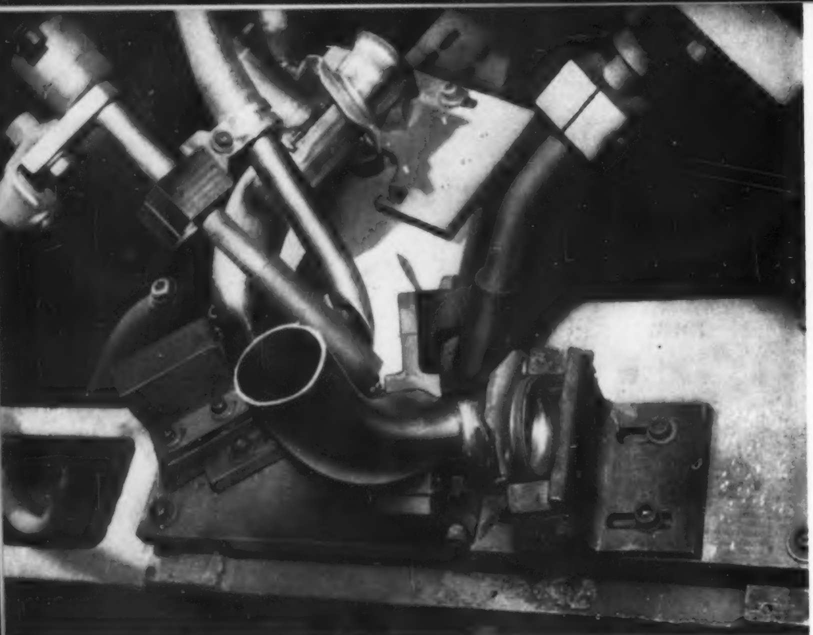


Fig. 4. For welding the two radiused edges, the work-fixture rotates on trunnions.

four different welders, each completing two seams at a time. Because of the multiple bends in the manifolds, it is impractical to weld both tees at the same time.

Besides producing welds of excellent quality, the whole production system is well integrated. Automatic operation of the welders, unloaders, and conveyors minimizes manual handling, thus speeding the process and keeping the total cost per weld remarkably low.

# Silicon: Key to Tomorrow's Automobile

The second most abundant element in the earth's crust today holds out the promise that your car of the future may be less expensive to produce and more economical to operate. That element is silicon. In refined form, silicon serves as an alloying element that gives additional hardness and wear resistance to aluminum, copper, and other soft metals.

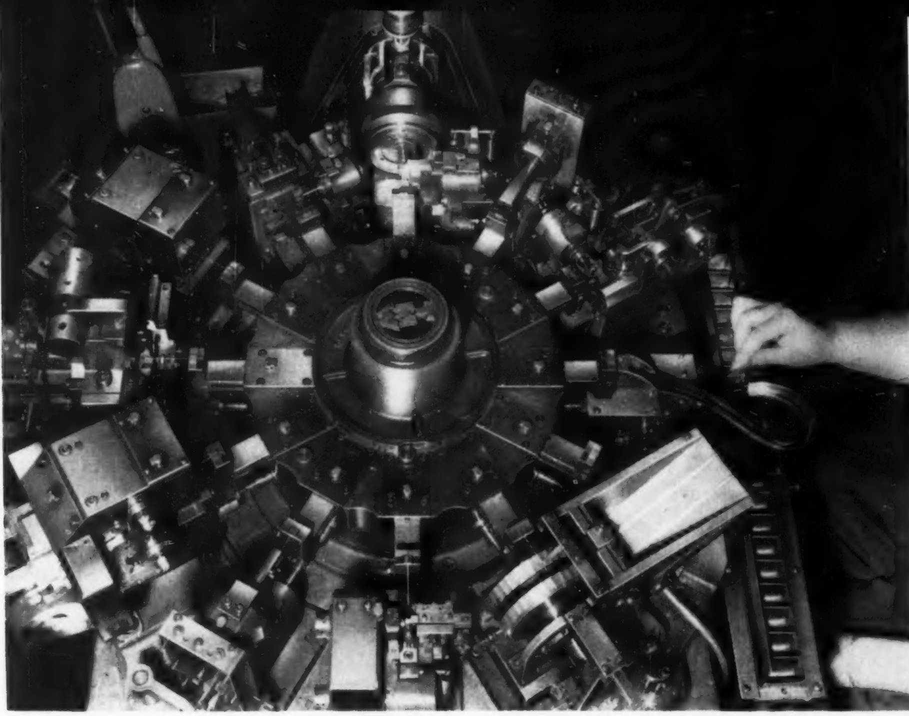
For forty years, Detroit has dreamed of automobile engines produced largely from lightweight aluminum. With silicon metal playing a key part, this dream may soon be realized as the result of advances in both engine design and casting techniques.

The advantages of a lightweight aluminum engine are readily apparent. By using aluminum in engine blocks and cylinder heads, weight can be reduced 30 per cent or more. With less weight to move, the car's acceleration, speed, and maneuverability are increased. At the same time, gas consumption is less, and other savings are effected. With less weight to carry and control, wear on brakes and tires is reduced.

The biggest roadblock in the path of automotive engineers has been the fact that aluminum wears quickly under the severe frictions of high-speed engines. For years, automobile manufacturers have experimented with various types of lightweight engine blocks, inserting liners in the cylinder bores or plating them with wear-resistant materials, such as chromium. Both high costs and foreseeable manufacturing difficulties have prevented their going ahead with these projects on a mass-production basis.

European auto makers have for several years been producing these "sleeved" aluminum engines, primarily for specialized sports and racing cars. Costs entailed in this type of production are generally prohibitive when translated into American assembly-line techniques, however. All hopes for mass production of lightweight engines now lie in alloying silicon metal and aluminum to form castings that will have sufficient wear resistance for today's high-compression engines.

Tennessee Products & Chemical Corporation, a subsidiary of Merritt-Chapman & Scott, produces silicon metal in its Roane Electric Furnace Plant, at Rockwood, Tenn. Completed in 1957, the plant features twelve of the largest and most modern electric furnaces in use in the world today. A wide range of ferroalloys, ferrosilicon among them, also are produced at Rockwood and at T P & C C's two other electric furnace plants at Chattanooga, Tenn., and Houston, Tex.



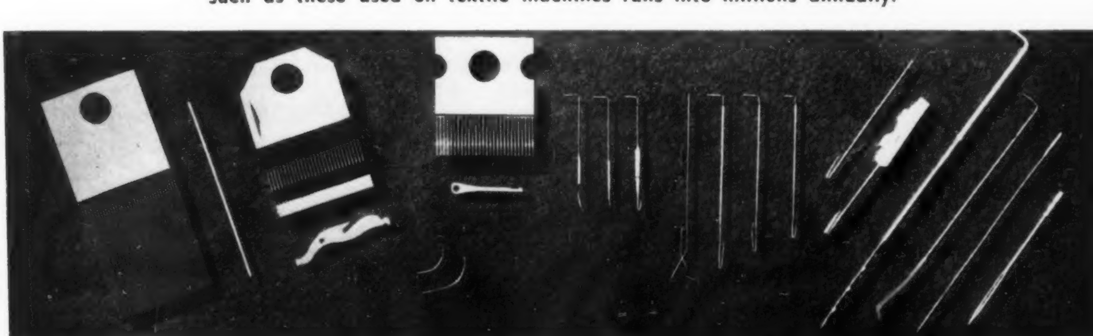
# Trip Around Turret Forms Precision Needles

ONE OF THE WORLD'S best concentrations of precision needle-making know-how is found at Reading, Pa., in the Wire Products Division of the Textile Machine Works. Equipment and skills involved in making needles have been developed as a natural adjunct to that company's long and dominant role as manufacturer of knitting, braiding, and tricot machines. Some of the needles used on these machines appear in Fig. 1. The division also is a source of surgical, hypodermic, and vaccinating needles, and a variety of precise miniature parts for different industries.

Needles, as TMW knows them, bear little resemblance to their dime-store counterparts. They are made in a variety of intricate configurations. Normal production tolerances are as fine as 0.0002 inch. Heat-treating becomes an art in itself.

Forming machines for many of the needles are company "specials." Typical of these are auto-

Fig. 1. Production by the Wire Products Division of precision needles such as these used on textile machines runs into millions annually.



matic machines for forming needles known as welt hooks. These needles are used in large quantities in the welt-turning attachment of the full-fashioned knitting machine. A close-up view of a welt-hook machine appears in the heading illustration.

The appearance of the welt hook after each step in the forming sequence on the machine is illustrated in Fig. 2. Actual size of a completed needle is shown in the inset. In previous operations the wire is cut to length, then one end is pointed on polishing equipment of the type seen in Fig. 3. From the rotating magazine on the right, the wire is fed onto a stationary belt in close contact with a large wheel. The wheel revolves clockwise, causing the wires to roll to the left. Only the shanks of the wires are directly beneath the wheel, the tips being exposed to two abrasive segments and a polishing head. Pointing is completed by the time the work drops into the tray seen on the left.

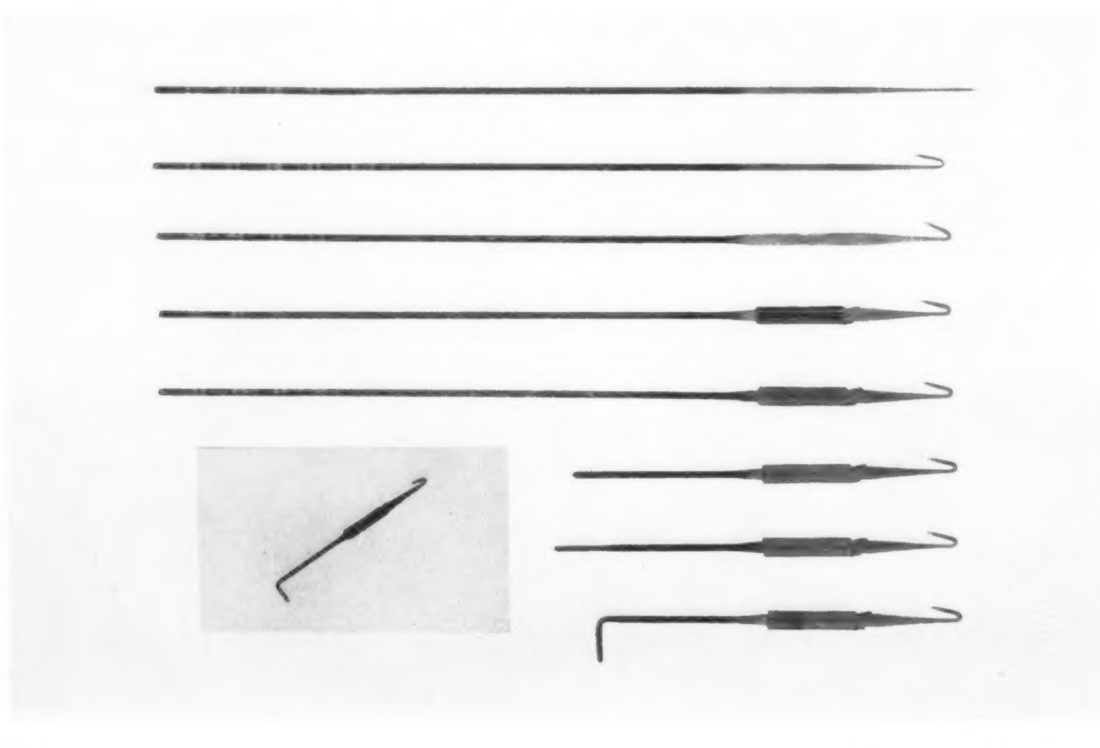
With the point completed (as on the top needle in Fig. 2), the work starts its processing on the welt-hook machine. As can be seen in the heading illustration, an indexing turret carries the work clockwise through eleven stations, starting at the lower right. At Station 1, a carrier receives the work from a magazine and presents it to one of the fixtures on each of the twelve faces of the turret. The point is bent to the form of a hook at Station 2.

When the needle reaches Station 3, it is rotated 90 degrees, and at Station 4 the area next to the hook is flattened. The die producing the flat also gathers the material in the center of the flat to create a tiny dimple on one side. From a second magazine, at Station 5, a small sleeve is ingeniously wrapped around the flat, location being made when a hole in the sleeve engages the dimple. At Station 6, the sleeve is pressed firmly in position.

About one-half the length of the long shank of the needle—required as a gripping surface in the earlier operations—is cut off at Station 7. Next, 1/8 inch of the remaining butt end is reduced in diameter by swaging at Station 8. After the work is again rotated 90 degrees at Station 9, the butt is cranked at Station 10. When the turret indexes to Station 11, the completed welt hook is ejected into a chute. (Station 12 is not used in this particular setup.)

Heat-treating the needles after they are formed must be done without either carburizing or decarburizing the work, since obviously, no metal

**Fig. 2. After pointing, the welt hook takes a trip around the turret of a special forming machine. Shape is shown at each stage of its transformation. Actual size of the finished welt hook appears in the inset.**



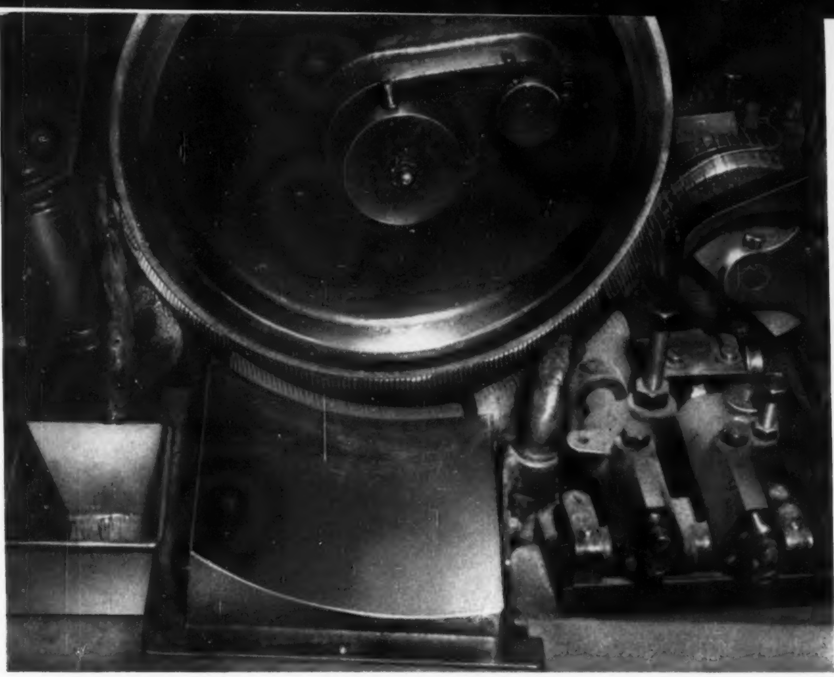


Fig. 3. A point is developed on one end of the needle in traveling beneath the wheel from right to left.

can be removed subsequently. Box and shaker-hearth furnaces are heated by various zones under control of precision instruments. A special quenching oil is used to leave the needles bright and requiring little or no cleaning after heat-treatment.

Dew-point instruments control the atmospheres produced by generators, and correct heat-treating is assured by continuous atmospheric chemical analysis. Tempering is done in various atmospheres and in oil. However, where exceptional hardness, toughness, and ductility must be combined, salt quenching and other isothermal transformation treatments are used.

## Functional Uses of Stainless Steel Highlight SAE Exhibit

Stainless steel in the automotive field is finding increased use in functional as well as decorative applications. This trend was pointed up in the exhibit of the Committee of Stainless Steel Producers, American Iron and Steel Institute, on display at the annual meeting of the Society of Automotive Engineers in Detroit early this year.

The exhibit was built around a life-size car outline made from expanded stainless steel to which stainless brightwork components were attached. This mock-up demonstrated graphically the increased use of protective stainless trim on 1959 cars, up 15 per cent over 1958 usage. A satin-smooth, stainless car roof panel welded directly to carbon-steel body parts indicates that automotive designers are capitalizing on stainless steel's strength, beauty, and durability. Functional applications on display included two all-stainless mufflers which promise greatly extended service life over conventional materials.

Shown for the first time was a stainless-steel head gasket for 1959 heavy-duty truck engines. Type 430 stainless was chosen for its resistance to gas erosion and heat, and particularly for its resiliency, which provides greater spring-back and thus affords a better seal between head and block castings of the truck engines.

Other stainless-steel automotive parts on display included functional body components, larger than similar sections of previous years; a Type 430 stainless-steel bumper; an experimental wheel made of Type 302 stainless; water-jacket distribution tubes; exhaust-manifold butterfly valves; a variety of parts fasteners; and heat exchangers.

Stainless is expected to be even more important to auto builders when air-cooled, rear-engine small cars are domestically produced, as the material can easily withstand the high-temperature conditions developed in compact engine installations. Additional experimentation is now moving forward in the area of all-stainless exhaust lines—from head pipe to tail pipe—with cast nickel-steel manifolds a strong possibility.

The Committee's display included demonstrations of spot-welding stainless steel to carbon steel, using conventional techniques. Since both stainless and carbon steels are ferrous materials, they can be welded without difficulty, and the shear strength of the carbon-to-stainless weld is greater than that of a carbon-to-carbon joining.

# Gun-Drilling Up-to-Date

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THE DEVELOPMENT of carbide cutting tools has revolutionized many machinery practices. But one of the most outstanding contributions of this development has been in the field of gun-drilling. The term "gun-drilling" is a misnomer derived from the practice of drilling extremely long holes in gun barrels when the problem was to produce some kind of a hole to extreme depths. Even though the process is now used on a vast variety of parts totally unrelated to guns, the term has persisted. Carburetor parts which have been gun-drilled for throttle-valve shafts are illustrated in Fig. 1.

The advent of carbide gun drills has opened an entirely new field because of the extreme accuracies with respect to both size and straightness obtainable with these tools.

Combined with this is a superior finish. Reaming is not required for close tolerances and smooth finishes. The magnesium missile component shown in Fig. 2 is gun-drilled to obtain a smooth hole 1/8 inch in diameter and 6 inches deep. Gun-drilling can often be used to advantage on holes no deeper than the diameter due to the possibility of eliminating subsequent finishing operations. It should be understood, however, that under certain conditions it is still necessary to perform secondary operations where finish specifications or diameter tolerances are extremely critical.

In general, the gun-drilling process can be used to advantage wherever the material is normally machinable. It is often possible to gun-drill with comparative ease materials that work-harden when drilled by methods which require withdrawing of the drill before completion of the hole. When a gun drill is used, the cut should never be interrupted until the hole is finished.

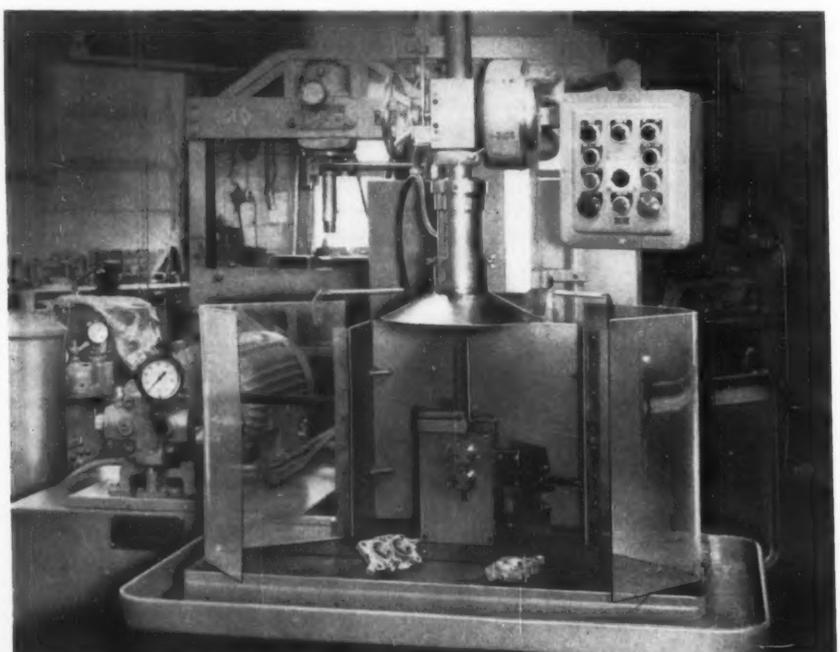


**Fig. 1. Holes for throttle-valve shafts are gun-drilled in these carburetor parts. A minimum gap is maintained between the guide bushings and the work-piece.**

This eliminates the work-hardening that is so often experienced, especially when drilling stainless-steel parts.

### *High Spindle Speeds—Low, Constant Feeds*

The spindle speeds used for carbide gun drills are very high compared with standard drilling speeds, but the feeds in terms of thousandths of an inch per revolution are very low. For these reasons a machine which will provide high spindle speeds without noticeable vibration should be used. Experience has indicated that for most materials, cutting speed is an important factor in obtaining optimum results. In many instances a change of as little as five per cent in the spindle speed will produce noticeably different results. It is important, therefore, that machine speed changes be easy to make, especially during the period when the setup man is determining the best speed.

For the same reasons feeds must be constant and easily changed. Once the feed is set, it is desirable to have the same rate of advance during each revolution of the drill. For instance, if it is determined that a feed of 0.0003 inch per revolution is best, it would not be desirable to have a feed of 0.0002 inch for one revolution and 0.0004 inch for the next, even though the average might be 0.0003 inch. This is especially true when the drill sizes are 3/8 inch and under.

End play in the machine spindle should be held to a minimum. In cases where feeds are in the nature of 0.0002 to 0.0005 inch per revolution, it would be undesirable to have 0.001 inch end play in the spindle. If this much play existed, the tool could possibly "hog in" and take a 0.001-inch cut during one revolution and nothing for the next several revolutions. Rigidity is as important to successful gun-drilling as it is to any precision machining operation.

Cutting-tool selection is of considerable importance in gun type drilling operations. Fortunately, great advances have been made in the geometry of cutting tools and in the materials used in their manufacture. Much information is now available regarding proper tool angles and types of carbide as well as approximate speeds and feeds to be used. Considering the large number of materials which can be gun-drilled, the need for more data regarding this important subject should be emphasized. However, a fairly accurate starting point for the gun-drilling of most materials is now available. Through observation of the chip and finish produced, examination of the cutting tool under a glass, comparison of the size of the hole obtained with that of the cutting tool, and other considerations, it is possible to quite accurately determine when the optimum speed and feed have been reached. Of course, one of the best measures of production efficiency is the number of holes between grinds.

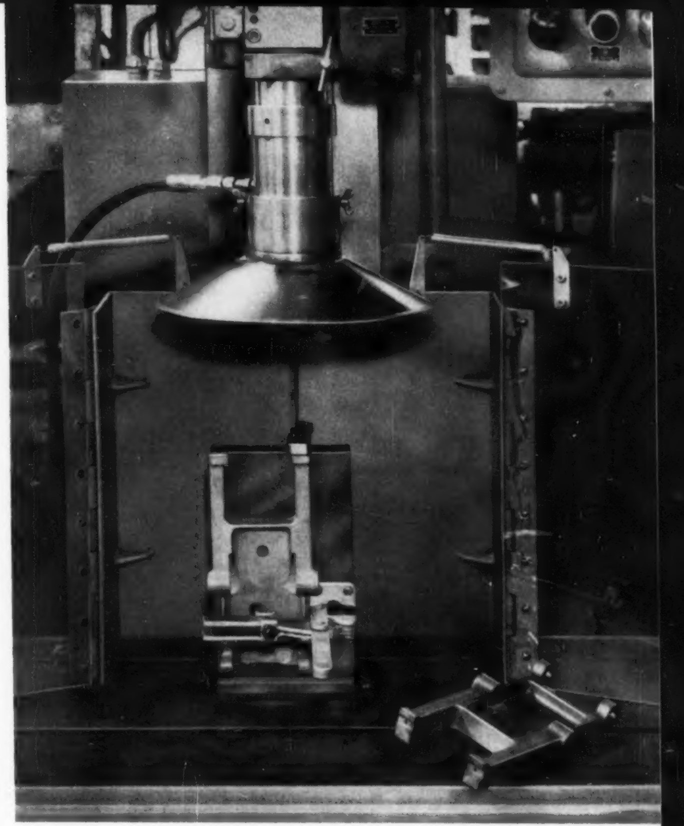


**Fig. 2. This magnesium part for a missile is set up for deep-hole drilling of a 1/8-inch hole to a depth of 6 inches. A smooth finish is obtained.**

### *Coolant Cleanliness Critical*

The importance of an adequate supply of clean coolant to the point of the cutting tool cannot be overemphasized. One of the most common mistakes made by the uninitiated is to gun-drill with an inadequate and improperly filtered supply of oil. Studies on this subject were recently made by one of the largest users of gun drills. The company found that one thousand holes could be drilled between grinds when oil which had been filtered to twenty microns was used. With no other change in the process except for filtering the oil to ten microns, five thousand holes between grinds were obtained. Recently the same company installed a filter which will eliminate all particles over two microns. Preliminary information indicates that this filter will enable between twelve and fifteen thousand holes to be drilled per grind. Finer filtration not only reduces the down time for drill grinding but also increases tool life.

Finish can often be improved by the use of

adequate coolant pressures. Experiments at Edlund show that the reduction of oil pressure below a certain value results in a poor finish, even though the chips may be eliminated from the hole satisfactorily. As a result, somewhat higher pressures than required simply for removal of the chips are now believed necessary to produce a fine finish. A seven- to ten-minute supply of oil in the coolant system is desirable. This provides a reasonable amount of settling time and thus prevents overloading of the filters. To reduce the dirt load on cartridge filters, a plate type filter, or in case of large production on cast iron, a mechanical filter, can be used ahead of the cartridge filter. A plate type filter should remove particles approximately forty microns and over and thus materially prolong the life of the cartridge filters.

A means of cooling the oil is helpful in most instances. This may be done by a thermostatically controlled solenoid valve which allows water to pass through a heat exchanger or by a thermostatically controlled refrigeration unit. Such a refrigeration unit is desirable in cases either where water is limited in supply or high in cost.

The use of safety devices—to prevent engagement of the spindle feed until the coolant pump is running and to automatically disengage the feed in case the coolant supply should fail—is strongly recommended. Such devices often prevent drill breakage, which can be expensive both from the standpoint of tool cost and that of the spoiled part. In many instances, such a part has received hours of processing before the drilling operation.

Although fixtures for gun-drilling operations should be rigid, they may be simple in design, since the torque and thrust required are relatively low. Wherever possible, the drill bushing should contact the surface at which the drill enters the work. Experience, however, has indicated that there are many cases where this is not essential, especially in the drilling of cast iron, die-casting metals, brass, and certain other materials. Nevertheless, better results are usually obtained where the drill bushing does touch the work. In general the gap should not be over one-eighth of the tool diameter. When drilling steel, the bushing should always be in contact with the work because of the possibility of chips catching between the end of the bushing and the part.

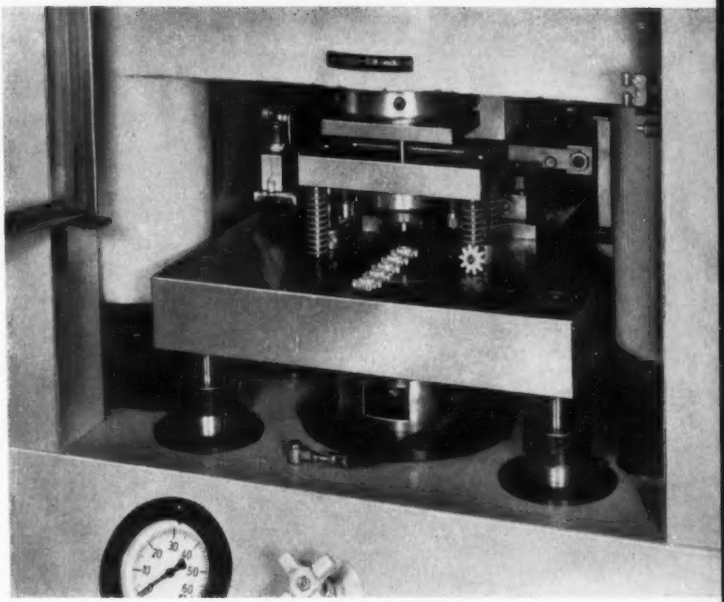
A drill bushing should fit the drill within extremely close tolerances. Generally, drills up to 3/8 inch in diameter require a bushing no more than 0.0001 inch larger in diameter than the drill. Research at Edlund definitely shows that a better hole finish—especially at the start of the hole—and a much longer bushing life are obtained where this close-tolerance policy is followed. For drills from 3/8 inch up to 3/4 inch, bushing clearance may be increased to 0.0002 inch.

### *Tolerances and Surface Finishes Attained*

The ultimate results that may be expected of gun-drilling are difficult to generalize because of the many variables, all of which have some effect on the process. However, it is possible to gun-drill holes 3/8 inch and smaller in diameter in aluminum, brass, bronze, magnesium, cast iron, and most of the high-carbon steels and free-machining stainless steels achieving diametral tolerances of from 0.0002 to 0.0004 inch and surface finishes of 10 micro-inches or smoother. In Fig. 3 a stainless-steel part is seen set up for gun-drilling three accurately located holes to within an 0.0003-inch diametral tolerance. Results in the low-carbon steels will not be as good. Surface finishes obtained in these steels are generally from 16 to 20 micro-inches, with drills up to 3/8 inch. Gun drills 3/8 to 3/4 inch in diameter can be expected to produce holes in materials of the former category with diametral tolerances of from 0.0003 to 0.0007 inch and a finish in the magnitude of 8 to 16 micro-inches. Similar-size holes in the low-carbon steels may be expected to have a finish of about 32 micro-inches.

**Fig. 3. Indexing fixture aids gun-drilling of 0.1250- to 0.1253-inch diameter holes in stainless-steel part. Location and parallelism are held within 0.0003 inch.**

**These secondary operations can speed the production of metal-powder parts that call for exceptionally close tolerances and better than average densities. But use of good tools and presses is essential.**



JOHN HALLER, President
Haller, Incorporated
Northville, Mich.

# Sizing and Coining of Metal-Powder Parts

AFTER SINTERING, many structural metal-powder parts require sizing to hold close tolerances—or coining to increase density. Frequently, a part will need both operations. In such cases tools are often designed to combine them in one setup. In some instances, more than one coining operation is applied along with additional sintering operations to produce parts of exceptionally high density and good grain structure. But for the majority of structural parts, this is more often the exception than the rule, most being completed after sintering and one sizing or coining operation.

In any case, good tools are essential for good results. The same precision and care employed in designing and making briquetting tools must be applied to those for sizing and coining. Occasionally, briquetting tools can also be used for sizing and coining, especially where dimensional changes in sintering are not excessive, or where the production volume is not so great that tool life becomes a problem. Sometimes, too, briquetting presses may be employed for these operations but more often entirely different tools are used in presses other than those used for compacting.

Sizing and coining, however, must be performed at production rates equal to or better than those obtained in briquetting and sintering. If they are not, the sintered parts have to be stored—or stacked up at the slower secondary operation—with resulting risk of losses through shrinkage or damage to the parts from excessive handling. Since manufacturing costs are higher with slow operations and storing and handling, the ideal situation is to balance the entire production flow.

Where coining or sizing is performed in fast-acting punch presses, the production rates are at least double those obtained in briquetting presses. Sizing and coining in these setups are usually faster than briquetting because solid parts can be fed to a die faster than powder can be delivered, and such considerations as the dwell period required to form the powder in briquetting are unnecessary. Universal presses developed by Haller, Incorporated, are capable of high-production rates in sizing or coining. Speeds range from eight to forty strokes per minute for an 18-ton press, while another having a capacity of 40 tons operates at a maximum of twenty-five strokes per minute. Besides sizing and coining, these presses can be employed for staking, assembly, and other secondary operations. With proper adjustments to suit the requirements of forming powder, they can also be used for briquetting. Such presses accommodate vibratory parts-feeding bowls and are equipped with shuttle feeders for rapid die loading in sizing and coining.

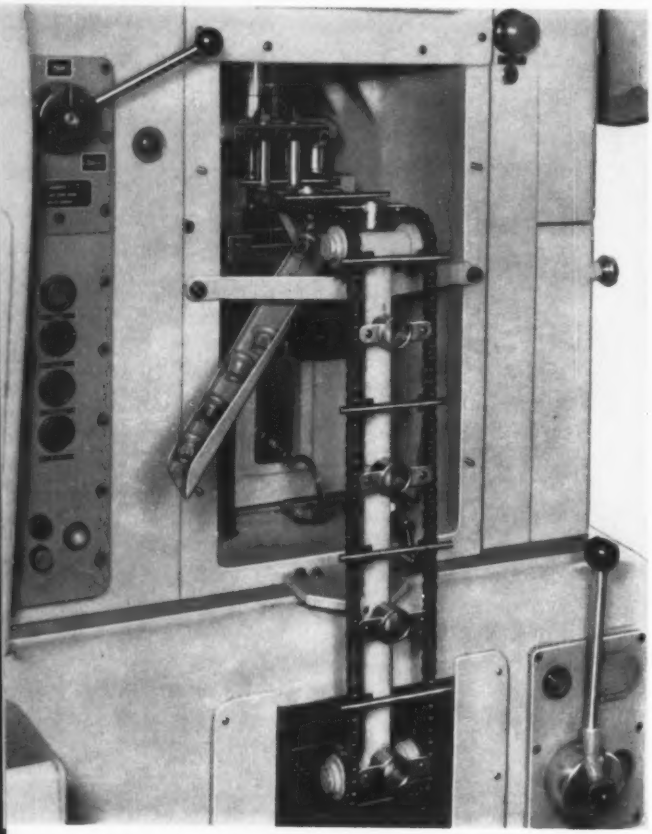


**Fig. 1. Continuous die loading from one direction is achieved by a chain drive. This mechanism replaces a reciprocating shuttle slide for parts of simple shape not requiring precise location or alignment.**

Various methods of loading a die can be used, depending on the type of part being processed or the kind of operation to be performed. A chain carrier (Fig. 1), for example, may carry cups, simple holding plates, or similar work-holding devices to the die. Occasionally, this chain-carrier setup is employed for assembling one part within another. In such cases, the shuttle feeder loads the die with one part after which the chain carrier delivers the other. The upper ram then descends to stake or press the two parts together. Generally, however, either one or the other of these loaders is used singly according to the requirements of the operation.

In the production of a combination ratchet and gear, for example, a 40-ton press (heading illustration) was used for both sizing and coining simultaneously. Dimensional tolerances were very close. Ten ratchet teeth on one face of this part were required to be central with the gear teeth within plus or minus 0.001 inch. The outside and root diameters of the gear could not vary more than a total of 0.001 inch. A tolerance of plus 0.0000, minus 0.0002 inch was to be held on the outside diameter of the ratchet while the minor diameter was to be maintained within plus 0.0000, minus 0.0005 inch.

These tolerances and the density required necessitated the use of especially good tools. A combination sizing and coining die, Fig. 2, was built to meet these needs. To obtain the long die life demanded by the production volume the core-pin and inserts for both the ratchet section and the gear portions were made of carbide.

In operation, a Syntron vibratory feeder delivers sintered parts to a stationary magazine located just above the shuttle feeder at the rear of the press (Fig. 3). The gears are oriented in the proper alignment with the die contour before entering the magazine. The magazine holds six parts and feeds them one at a time into a contoured recess in the reciprocating shuttle carrier. An air-cylinder ram applies a light load on the parts stacked in the magazine to insure proper seating of the bottom part in the slide recess.

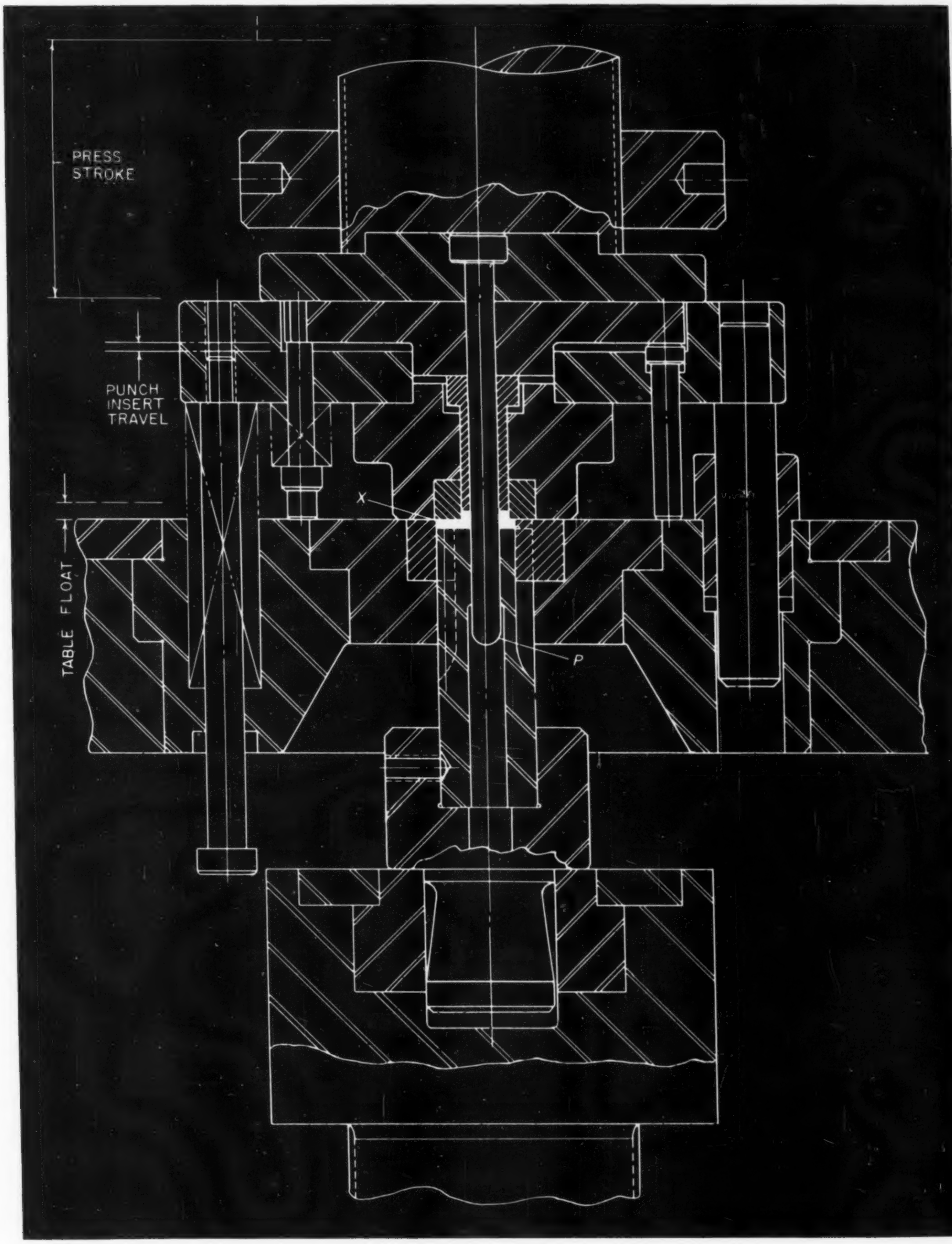
The upper die on the press ram contains the insert for the ratchet and the carbide core-pin. This assembly is connected by means of guide pins and springs to the lower die in which the gear insert is located. The lower assembly is mounted on a spring-loaded floating table so that separation of the two assemblies under spring pressure provides clearance, allowing entry and exit of the shuttle slide for automatic loading.

On the up stroke of the press ram, the shuttle advances, removing an ejected part and simultaneously placing a new piece over the die. Return of the shuttle for another piece is made possible by a U-shaped opening in the slide which clears the core-pin when it enters the bore of the part. This core-pin action positions the part in the die cavity into which the part drops, being slightly smaller than the die. Further downward movement of the core-pin sizes the bore before the part is completely coined.

As the ram continues the down stroke, the upper die is brought into contact with the part. Pins extending from this assembly depress the floating lower die a short distance so that the ratchet portion of the part is forced into the upper die for coining. Finally, pressure from the upper punch against the part in contact with the lower punch decreases the thickness of the component a predetermined amount. This causes the metal to flow radially about 0.002 to 0.003 inch on a side, filling out the contours of the gear and ratchet teeth in their respective die sections.

The technique of coining a part to fill the contours of a precisely built die eliminates distortion from spring-back which usually occurs when

Fig. 2. This die is designed to size and coin 1500 parts per hour. The work-piece (X) is a gear with an integral ratchet on one face. Close control of operations is obtained by multiple motions of the tools and press. The upper die allows lost motion while the core-pin (P) sizes the gear bore. In addition, the lower die floats downward on springs as the ratchet portion of the part is forced into the upper die.



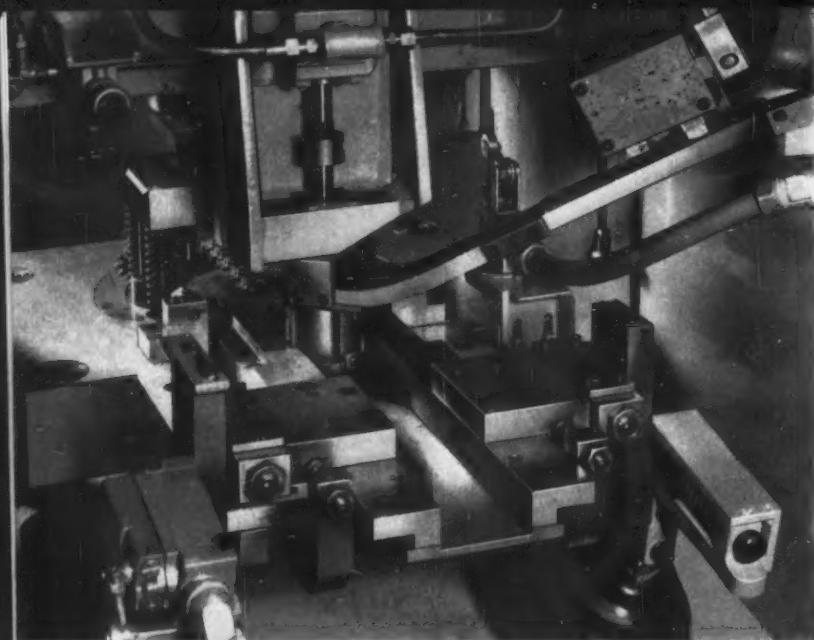


Fig. 3. Automatic devices on this universal press feed the sintered parts for sizing and coining. A vibrating hopper first orients and then loads the gears into a magazine which delivers them singly to a contoured recess in a shuttle feeding the die.

the part is forced through a smaller die to shave it to size. Most important, however, is the dimensional accuracy achieved and the close control of the density increase obtained.

When the ram starts to ascend, spring pressure simultaneously raises the lower die. During this upward movement of the lower die the spring-loaded upper punch holds the gear for a short period in the lower die. This releases the part from the upper die. Ejection from the lower die occurs when the lower punch rises to the top of the die. When this stroke is complete, the part rests on top of the lower die cavity—ready for removal by the shuttle slide. The production rate obtained with these tools in the universal press is about 1500 pieces per hour. Tolerances are held without difficulty and the density of the parts is consistently increased 10 per cent.

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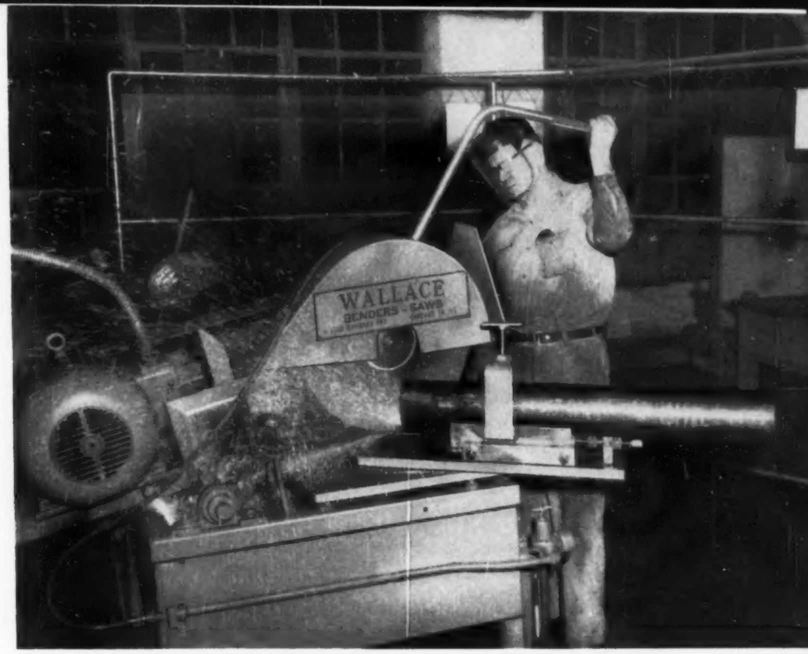
Railroad maintenance shops are using this single piece of equipment to lap two surfaces of different geometry simultaneously. Work-pieces are air-brake valve components. Valve faces are lapped in a conventional manner right on the table. At the same time, small blocks move in and out radially to lap internal surface of valve seats located around the table. The blocks are attached to the ends of telescoping arms driven by a crank in the table center. Machine is a Lapmaster Model 24, built by Crane Packing Co., Morton Grove, Ill.

# Pipe Joints Prepared in Minutes

**The close fit obtained makes possible a good root-pass— the "secret" of a strong weld.**




A METHOD of rapidly preparing the ends of pipes or tubes to be joined in welded structures has been developed by the Wallace Supplies Mfg. Co., Chicago, Ill. In a recent field demonstration at the New York Naval Shipyard, Brooklyn, N. Y., pipe joints at various angles were prepared—complete with welding groove—in a few minutes on the cutoff machine seen in the heading illustration. The ends of aluminum and steel pipe were prepared with about equal facility. A maximum of three cuts per joint were required.

In this process, known as the DeWitt system, the pipe is clamped in a sliding V-block arrangement secured to a fixture which can be pivoted to various angles on the machine table. For the first cut, the fixture is set at an angle obtained from data in a book of copyrighted charts. The pipe is repositioned after the first cut to a second chart setting and the second cut is made. Similarly, the pipe is indexed to a third chart setting for the third cut. A joint end prepared by this method is, in most cases, ready for welding at completion of the third cut (Fig. 1).

An abrasive cutoff wheel is used on all ferrous materials, including stainless steel, while alumi-

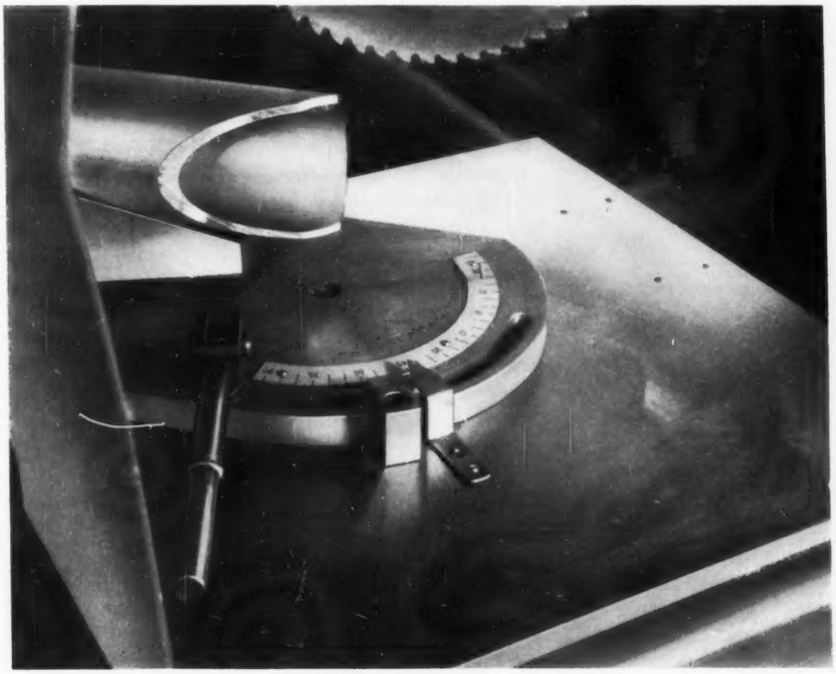


**Fig. 1. Special fixture on this cutoff machine holds an aluminum pipe in position for the third and final cut. Cutter is a 20-inch diameter, carbide-tooth saw.**

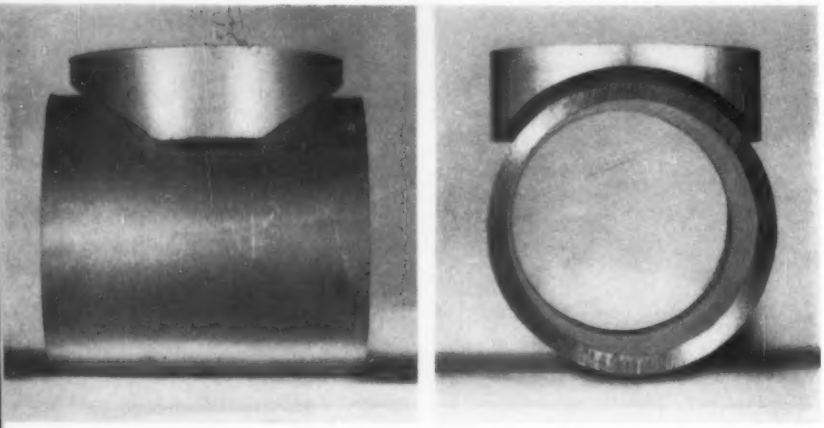


Fig. 2. This 2-inch structural pipe joint was prepared for welding on a machine of the type seen in the heading illustration. The two views show the welding groove and uniform fit obtained.

num and other non-ferrous materials are cut with a carbide-tooth saw. In the shipyard demonstration, 6-inch aluminum tubing and 4-inch steel pipe were processed, using either a 20-inch diameter saw or cutoff wheel on the machine spindle.

A T-joint of 2-inch pipe prepared in this manner is shown in Fig. 2 and a 45-degree joint of 4-inch pipe, in Fig. 3. In each case, a uniform fit and a groove suitable for a good structural weld is obtained. In aluminum, T-joints of 2-inch pipe can be prepared in 30 seconds, 4-inch pipe in 1.1 minutes, and 6-inch pipe in 1.7 minutes. Preparation of the same type of joints in mild steel, stainless steel, or SAE 4140 steel requires 40 seconds for 2-inch pipe, 1.35 minutes for 4-inch pipe, and 2.35 minutes for 6-inch pipe.

The system allows the making of joints at included angles of 35 to 90 degrees and pipe ends can be prepared for joining to a pipe of equal or larger size. Complex or cluster pipe joints may also be processed. Only a few minutes are required to change machine operations from one pipe size to another.

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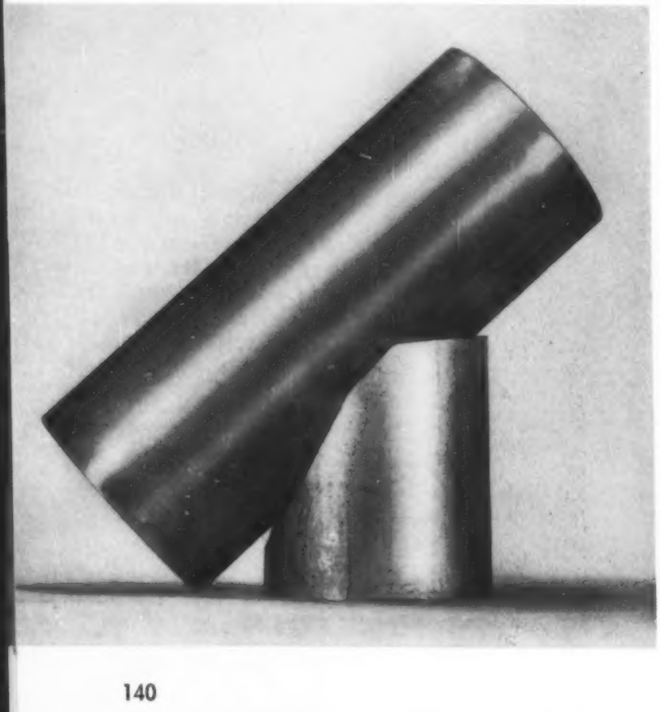
Fig. 3. A 45-degree joint in 4-inch pipe prepared for welding by the same method requires only three cuts. This joint can be prepared in a little over a minute.



## Titanium—1958 in Review

The titanium industry in 1958 began to pick up substantially from the low point of late 1957. Mill shipments averaged slightly better than 400,000 pounds per month as the industry tallied a 2500-ton year—a little less than 50 per cent of 1957's record. Although 1958 marked the first time in the brief eight-year history of titanium metal that a production advance was not recorded, shipment patterns indicate the solid base on which the titanium industry is built and the gradual market diversification made possible through product development and technical service.

Shipments of titanium to builders of commercial aircraft showed a 50 per cent improvement over 1957. This is partly due to the big changeover in carrier fleets in 1958. Sales of titanium for use in military aircraft rallied over those of late 1957, but over-all shipments showed a decline.

Use of titanium metal for missile applications in 1958 was largely in prototype manufacture of liquid-fueled vehicles. As missiles move into production, shipments to this market will increase correspondingly. The titanium industry is geared to provide the high-strength products required as the liquid-fueled, long-range missiles are joined by solid-fueled models.

# MATERIALS

**The properties and new applications of materials used in the mechanical industries**

### Air-Hardening Die Steel for Blanking and Punching Operations

Vulcan "Alidie," an air-hardening, high-carbon chromium die steel which can be used in blanking and punching operations on knife blades and other cutlery, has been announced by H. K. Porter Co., Inc., Vulcan-Kidd Steel Division, Aliquippa, Pa. This die steel is easy to machine and heat-treat and can hold a sharp edge over long periods of time. It is available in bar, billet, block, and forging form in regular and free-machining types.

### Tungsten-Carbide Spray-Powders for Hard-Facing

Tungsten-carbide spray-powder materials for use with the "Metco ThermoSpray Gun" that facilitate hard-facing with sprayed tungsten carbide have been developed by Metallizing Engineering Co., Inc., 1101 Prospect Ave., Westbury, N. Y. The coating speed for these "Metco Tungsten Carbide ThermoSpray Powders" and the specialized gun ranges from 110 to 150 square feet per hour, 0.001 inch thick. Any required coating thickness may be applied. After being deposited the coatings are torch-fused. The close control of coating thickness permitted plus the comparatively smooth surface produced minimizes finishing operations. Applications include parts subject to extreme wear conditions such as buffing fixtures, sanding templates, polishing masks, tool joints, and metal patterns.

### Nitrile Silicone Rubbers Have Varied Applications

Three products in a new family of nitrile silicone rubbers, "NSR-X5602," "NSR-X8701," and "NSR-X4803" have been announced by General Electric Silicone Products Department, Waterford, N. Y.

"NSR-X5602" has intermediate fluid resistance and is intended for intermittent contact with high-swell fluids or continuous immersion in milder fluids. A 60-durometer, relatively low modulus stock, this material is suitable for such applications as airframe seals, diaphragms, and shock mounts. It can be fabricated by extrusion, molding, or calendering.

The second product in the group, "NSR-X8701," features high-temperature oil resistance. It is a 70-durometer rubber suitable for O-rings, gaskets, oil seals, and other molded parts continuously immersed at elevated temperature.

An 80-durometer material with intermediate resistance to high-temperature fluids, the third nitrile silicone rubber, "NSR-X4803," is principally for oil seals in automotive transmissions. It will also be useful in O-rings, gaskets, and similar molded, extruded, or calendered parts for use where the fluids encountered are not severe in effect or immersion is not continuous.

### Leaded-Steel Tubing that Facilitates Machining

A leaded-steel tubing known as "Ledloy 170" has been announced by Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill. This leaded-steel tubing, which is available from warehouse stocks, is a cold-drawn, seamless steel tubing of low-carbon analysis with 0.15 to 0.35 per cent lead added. The numerical designation "170" indicates that it may be cut with an average cutting speed of 170 sfpm (surface feet per minute).

### Additive Boosts Paint-Stripping Power of Alkaline Solutions

A new additive, designed to enable alkaline paint-stripping solutions to be effective on difficult-to-remove finishes, has been developed by Oakite Products, Inc., 126 Rector St., New York 6, N. Y. Known as "Oakite Stripper Additive No. 4," the new product is a solvent. It converts a stripping solution of limited application into one capable of removing epoxy, acrylic, and similar tough finishes. Use of this additive, according to the manufacturers, makes it possible to salvage rejects economically, and to remove paint build-up from equipment used in the painting operation. The new material is added

to alkaline solutions in amounts ranging from 10 to 20 per cent by volume.

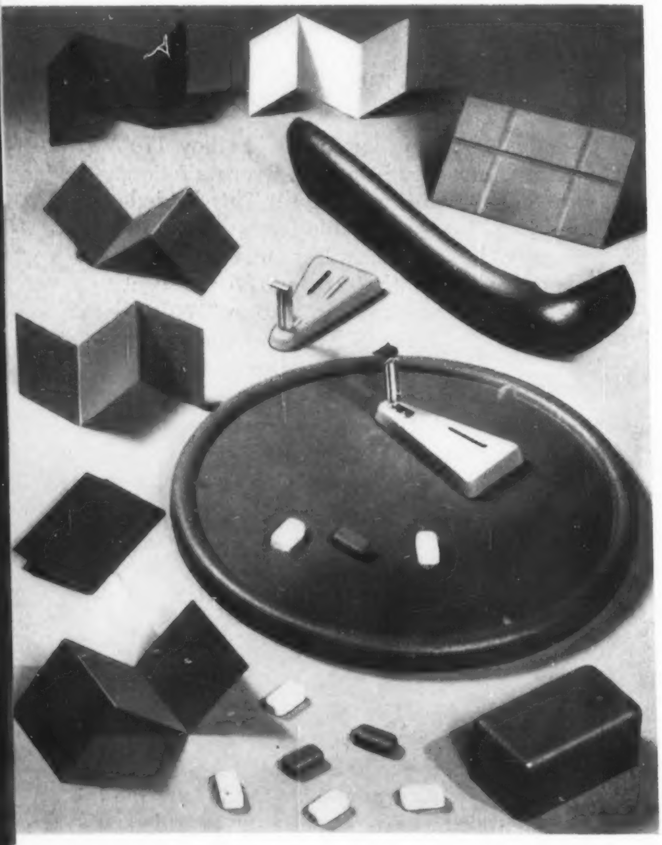
### Formable Vinyl-Coated Steel Sheet with Textured Finish

Vinyl-coated steel sheet, produced by curing and bonding liquid vinyl plastisols to the steel in a continuous coating process, has been announced by the United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa. Available in many textures, "USS Vinyl Coated Steel Sheet" can be embossed with any pattern that can be engraved on a printing roll and made in any specified color. This material may be fabricated in much the same manner as cold-rolled sheet without damaging the coating or changing the color. In most cases it can be worked on present production dies.

The vinyl coatings are from 0.008 to 0.020 inch thick and the thickness may be specified in increments of 0.001 inch within this range. Coating hardness is from approximately 60 to 90 Shore A durometer. The steel sheets are available in gages from 18 through 28. Widths range from 24 to 52 inches, and lengths from 30 to 144 inches. The material can also be obtained in coils. Texture embossing is to a maximum depth of 0.005 to 0.006 inch. The sheet can be sheared, slit, punched, lock-seamed, stamped, drawn or roll-formed, easily withstanding an elongation of 30 per cent. It can be welded by several methods and can be fastened in almost as many ways as steel. Parts formed from vinyl-coated steel are seen in the accompanying illustration.

Vinyl-coated steel is heat resistant. It will withstand 160 degrees F. on a continuous exposure basis, 212 degrees F. for two days, but will soften appreciably at 350 degrees F. and char at above 400 degrees F. It will not, however, support combustion. In addition, the vinyl coating is scuff and abrasion resistant and is not stained by conventional die lubricants, alkaline cleaners, detergents, or acid cleaners. Applications include automobile interiors, appliance cabinets, and architectural products.

**These parts, made from vinyl-coated steel sheet, vary from flat work to those requiring deep drawing, such as the box in right foreground. The new material can withstand elongation of at least 30 per cent without damage to the embossed coating.**



### Hard-Facing Alloy for Hot-Working Dies

A hard-facing welding alloy, called "Rexweld 66," has been made available by the Crucible Steel Company of America, Oliver Bldg., Pittsburgh, Pa. It is a cast alloy containing nickel, chromium, molybdenum, and tungsten especially designed for hot-working applications. Highly resistant to thermal shock and impact and compressive loads at high temperatures, this material will not chip or spall under severe service. The electrodes have a special low-hydrogen coating that allows all-position welding of various tool and die steels without cracking or porosity of the weld metal. Primary application of the hard facing is to drop-hammer forging dies. It is said to have excellent machinability with high-speed steel tools in the as-welded condition.

### Quick-Drying Enamel Cuts Down Time for Painting

A quick-drying enamel that permits use of surfaces fifteen minutes after painting has been announced by Consolidated Chemical & Paint Mfg. Co., Inc., 456 Driggs Ave., Brooklyn, N. Y. Known as "Jet-Dri," this enamel will produce a smooth, even-textured coating over concrete, metal, and wood surfaces. It can be applied by brush, roller, dip, or spray, and has high resistance to abrasion, alcohol, corrosion, and weathering. Typical applications are loading platforms, fork loaders, and other equipment for which only limited painting time is available.

# INGENIOUS MECHANISMS

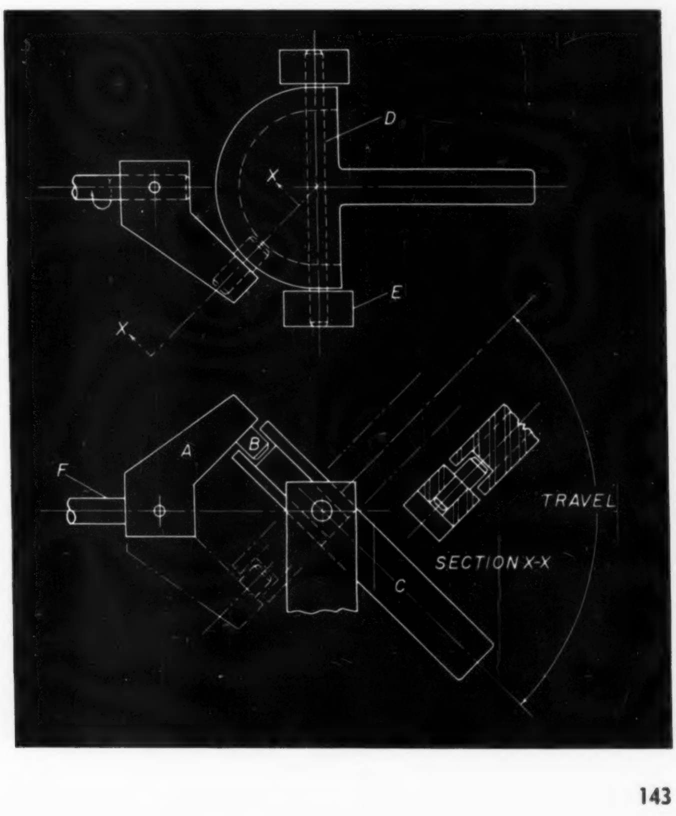
**Mechanisms selected by experienced machine designers as typical examples applicable in the construction of automatic machines and other devices**

## Converting Rotary Motion from Continuous to Oscillating

CLIFF BOSSMANN, Dayton, Ohio

A device that transforms a continuous rotary motion into an oscillating rotary motion is here illustrated. The arrangement is compact and the axis of the rotation of the output is perpendicular to that of the input.

Driving arm *A* has a drive-pin *B* which engages in a semicircular groove in a driven member *C*. This driven member is permitted to pivot freely on pin *D* which is retained at each end in a support block *E*. Pin *D* is made a press fit in one block and a slip fit in the other. It is important that the axis of pin *D* intersect the axis of drive-shaft *F* and the axis of drive-pin *B* at a common point. Oscillating output of the mechanism is derived from the integral arm extending from member *C*. The total movement of this arm, in degrees, is equal to twice the angle at which the axis of the drive-pin intersects the axis of rotation of arm A. Many variations in the design of this mechanism are possible.




**Arrangement that produces an oscillating rotary output from a continuous rotary input. The mechanism is shown at a different position in each view.**

# High-Speed Spiral Scanner

B. J. Popper, Kfar-Ata, Israel

In radar, television, and other systems involving the reception of electromagnetic waves, the need frequently arises for a high-speed spiral scanner. In this case, the scanner consists of a mirror held in an adapter actuated by a power-operated mechanism. The mirror is tilted at a constantly changing angle with respect to an axis passing vertically through its center. At the same time, the direction of the tilt continuously changes through a complete circle of 360 degrees. Thus, the motion of the mirror is such that it can "see" any object within the angle of its cone of motion.

The mechanism built to provide the required scanning motion, which has been performing satisfactorily, is shown in Fig. 1. The requirements for this particular instrument were these: operational speed had to top 10,000 revolutions per minute; the mirror or antenna adapter *K* (see diagram Fig. 2) had to scan a cone opening angle *O* of 12 degrees, the axis y-y of axle *J* pivoting about point *H* while point S at its lower end described a spiral of twenty turns between 0 and 12 degrees—that is, the scanner had to cover its field ten times per second when drive-shaft *B*, Fig. 1, was operating at 12,000 revolutions per minute; and the center of the conic motion had to be at point *H* on the upper surface of the adapter *K*. Finally, it was necessary that the instrument be simple and easy to construct. Thus, the axle *B* of the main shaft was designed to (1) revolve at a speed of 12,000 rpm; and (2) move the lower

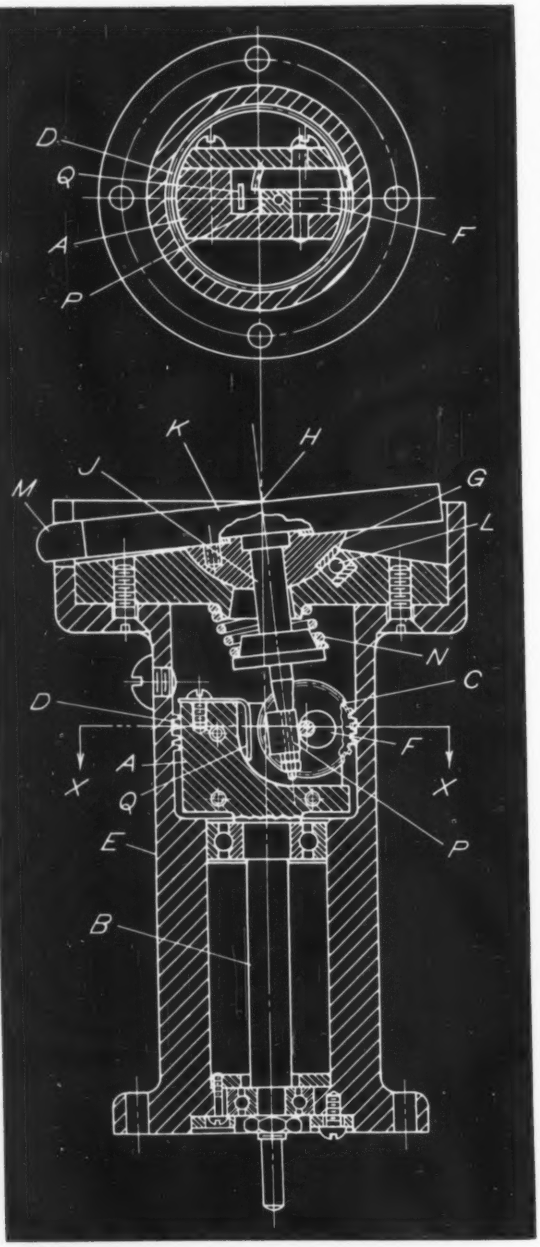
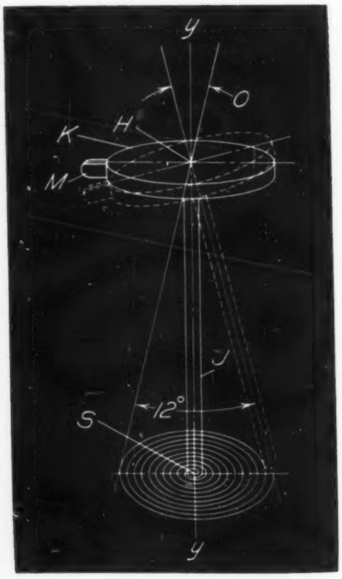



**Fig. 1. (Left) High-speed spiral scanning mechanism in which the conic motion of the scanner (K) is set up by gear (C) turning on its own axis while its carrier (A) rotates at high speed around the axis of main shaft (B).**

**Fig. 2. (Below) Diagram illustrating the basic operating principle of the spiral scanning mechanism, Fig. 1.**



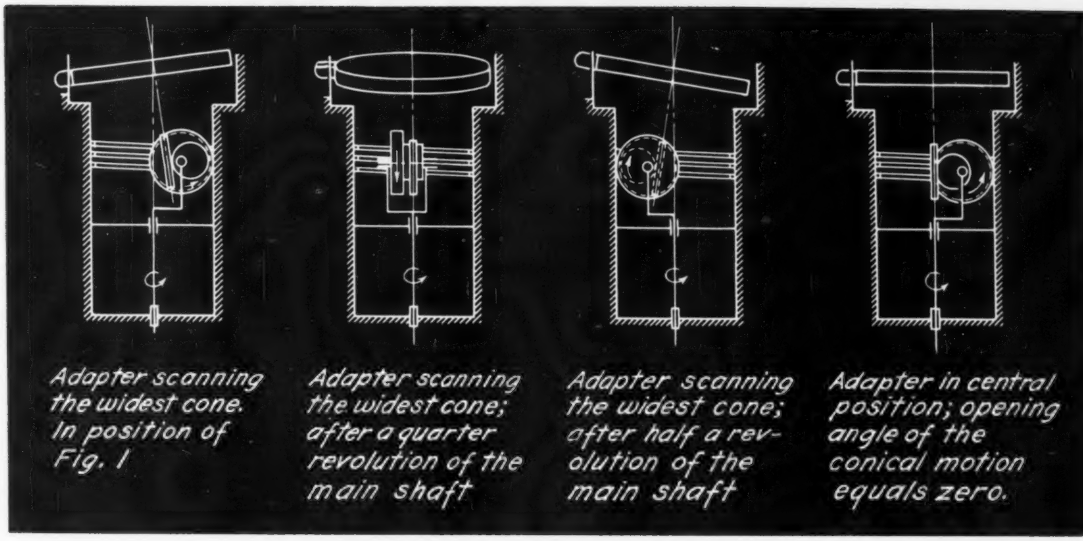



**Fig. 3. Diagrams showing relative positions of the moving parts of spiral scanner at different periods of the operation cycle.**

end of axle *J* outward from its vertical, or zero, position toward the widest cone angle scanning position, and return to the zero position once every forty revolutions of axle *B*. In Fig. 2, the axle is shown in vertical position (solid lines) and in widest scanning position (broken lines). The relative positions of the moving parts during this operating cycle are shown by the diagrams in Fig. 3.

Carrier *A*, Fig. 1, is integral with main shaft *B* and must be balanced. Helical gear *C*, having forty teeth, has its bearings fixed in the carrier, and meshes with the internal worm thread *D* in housing *E*.

Cam *F* is fixed to the gear *C* and revolves with it. Spherical section *G*, having its center at *H*, and the axle *J* are attached to adapter *K*. Since the spherical section rests on three equally spaced balls *L*, it can easily be given the continuous tilting or conic motion required. The adapter, spherical section, and axle are prevented from revolving with carrier *A* by projection *M* which engages a slot in the housing *E*. Spring *N* holds the spherical section in its seat. Slider *P*, carried on the axle *J*, is free to rotate around it. The slider is positioned between the gear and the carrier.

In operation, the gear *C* and cam *F* move as a unit with the carrier, rotating at high speed with the main shaft *B* so that the axle *J*, spherical section, and adapter perform the required conic motion. At the same time, the worm thread *D* causes the gear *C* to revolve around its own axis while centrifugal force presses the slider *P* against the cam *F*. Since the gear and cam are also revolving around the gear axis, the opening angle of the cone varies continuously as dictated by the shape of the cam, thus producing the required spiral scanning motion.

When the slider reaches the center, flat spring *Q* thrusts it against the cam, replacing the centrifugal force, and a new scanning cycle begins. The housing is partly filled with lubricating oil, and the high speed of the mechanism serves to create effective mist lubrication.

• • •

## Automotive Safety a Prime Concern of Manufacturers

Motor vehicle manufacturers in the United States spend between five and six million dollars yearly on engineering research to increase automotive safety. In the case of one company, it is estimated that approximately one-third of its annual one-million dollar safety-research budget is devoted to the problem of safely packaging passengers. Another one-third is allotted to safety control of vehicle components, and the remaining one-third is spent on projects such as lighting and the development of general safety equipment. From $200,000 to $250,000 is spent each year just on brake-development programs by one particular company.

In addition, the industry cooperatively contributes large sums of money to outside research programs and other safety activities through the Automobile Manufacturers Association. During 1958, these grants totaled more than $1,500,000.

# TOOL ENGINEERING *Ideas*

**Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work**

## Spiral Chasing Attachment

JOSE C. SOBKOWIAK, Jackson, Mich.

An arrangement that permits the lathe chasing of spiral grooves is here illustrated. The radial position of the tool is controlled by a linearly moving cam driven indirectly by the lathe lead-screw. With the proper cams, spirals having either a constant or variable pitch can be produced.

A spur gear *A* (Figs. 1 and 2) is pinned to the lead-screw *B* at the tailstock end of the lathe. This gear rotates in mesh with a second spur gear *C* keyed to a special drive screw *D*. Gears *A* and *C* are of the same size but drive screw *D* has a lead twice that of the lead-screw. A bearing *E* is clamped to the lathe bed *F* and supports the right-hand end of the drive screw.

Member *G*, essentially a half-nut, is free to pivot on a special screw secured in a supporting plate *H*. This half-nut is engaged with the drive screw by the action of a lever *J*. A spring *K* holds the half-nut in contact with the lever and two cap-screws secure the plate to the lathe tailstock *L*. Bearing *M*, also attached to the tailstock with cap-screws, supports the drive screw in the area below and adjacent to the half-nut. This bearing is bored slightly larger than the major diameter of screw *D* and is slotted at 90 degrees to the bore to receive member *G*. A stop *N* is positioned on plate *H* so as to limit the movement of lever *J* when both engaging and disengaging the half-

**Fig. 1. Lathe lead-screw (B) is geared to drive screw (D) of the spiral chasing attachment.**

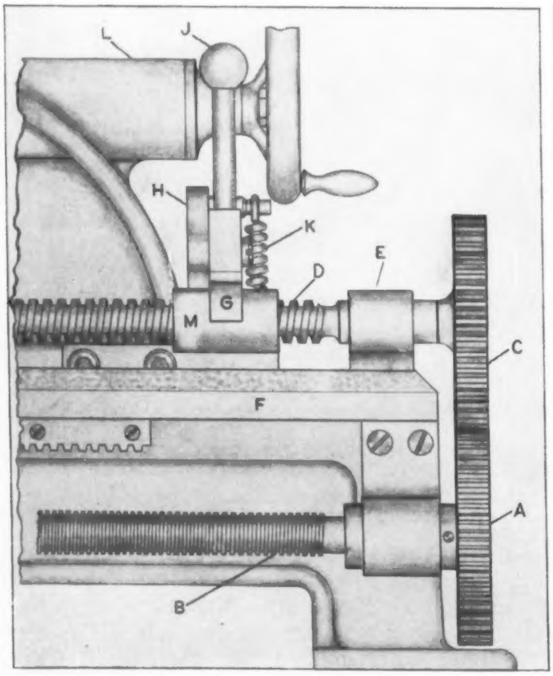
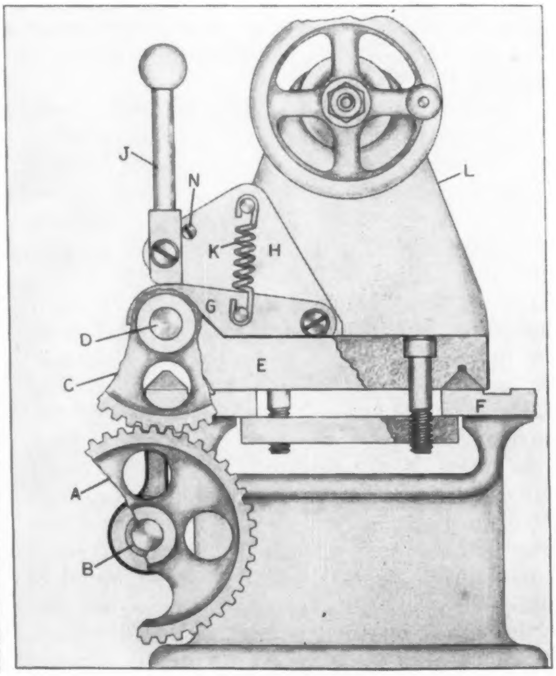



**Fig. 2. Half-nut engaging mechanism is seen here in detail. Lever (J) operates the half-nut (G).**



nut. Spring *K* quickly releases the half-nut when the lever is moved to the open position.

Cam holder *O* (Fig. 3) is retained in supporting member *P* by two knurled adjusting nuts *Q*. Member *P* in turn is secured by screws to the rear of the tailstock. Holes are provided in the adjusting nuts for the use of spanner wrenches when setting a cam *R* in its proper longitudinal position. For constant pitch leads, the cam is made in the form of a right-angle triangle having the base equal to twice its altitude, as seen in Fig. 3.

Cam *R* is attached to the cam holder by cap-screws and dowels, is supported by the lower cross-slide of the lathe, and is held in contact with guide S by a roller follower *T*. Guide S, made in two parts fastened by cap-screws and dowels, is secured to the rear of the lathe carriage. Roller follower *T* is free to rotate on a threaded pin in a member *U* that is attached to the upper cross-slide. The cross-slide feed-screw nut is disconnected and a weighted cable *V* is used to keep both the follower in contact with the cam and the cam in contact with the guide. Cable *V* is retained in post *W* by a screw and passes over a pulley (not shown) attached to guide S.

This device was used on a lathe having an 8-pitch lead-screw, and the gear change box set up for cutting four threads per inch. Since gears *A* and *C* are of the same size, lead-screw *A* and, consequently, drive screw *D* make two revolutions for each revolution of the work-piece *X*. Screw *D*, having a lead twice that of the lead-screw or 0.250 inch (four threads per inch), will, therefore, advance the tailstock and the cam 0.500 inch as the work-piece rotates once. Since the cross-slide is moved toward the operator at twice the rate the cam is advanced by the drive screw, tool *Y* will cut a spiral groove with an 0.250-inch lead.

Thus, spiral grooves having many other pitches can be obtained simply by changing the gears on the lathe to those that would ordinarily be used to cut a thread of that pitch required. If the lathe on which this device is to be used does not have an 8-pitch lead-screw, the same results are obtained by giving drive screw *D* a pitch double that of the actual lead-screw. Although one cam is used for constant-pitch spiral grooves, accelerating and decelerating leads may be cut using cams with a curved face. Layout of such cams is a simple operation and can be based on the one cam employed for cutting constant-pitch spirals. When chasing a spiral groove having an accelerated or decelerated lead, a stylus with a rounded but relatively sharp nose is used to replace the roller follower.

The carriage is locked in place during chasing and the compound slide is positioned parallel to the ways. Depth of cut is set by means of the compound feed dial. Also, the threading dial is employed in conjunction with lever *J* in the same manner as the half-nut lever would be used during a normal threading operation.

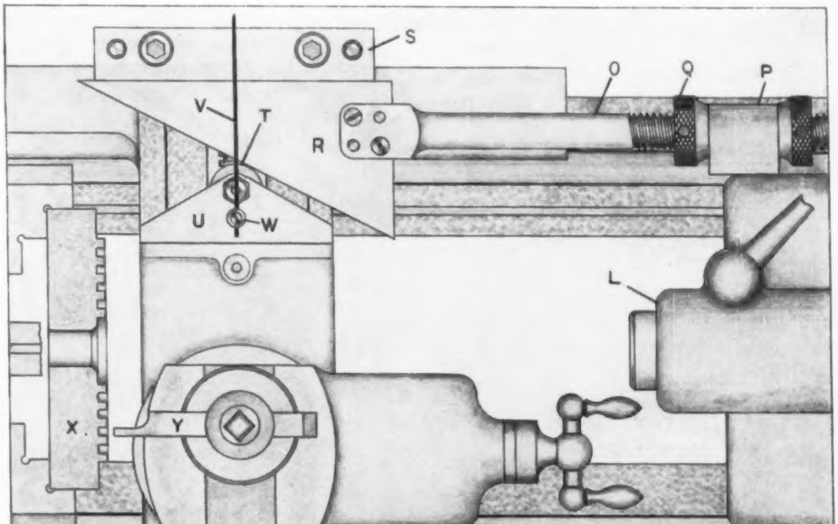
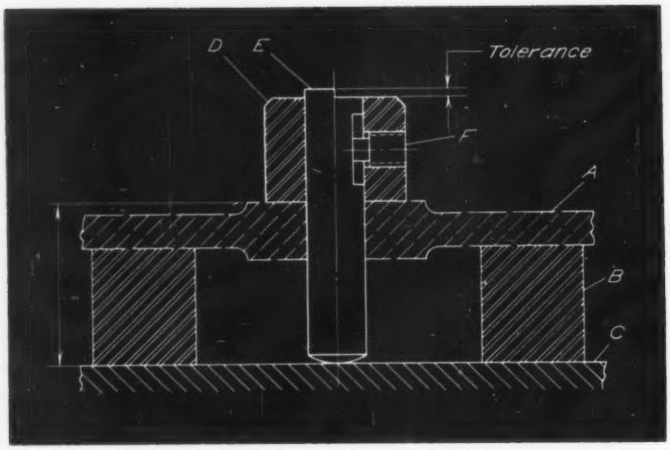



**Fig. 3. Tailstock (L), cam holder (O), and cam (R) are advanced toward the headstock by engaging the half-nut with drive screw (D). Cam (R) causes the tool (Y) to chase a spiral groove by moving the cross-slide against the restraining force of weighted cable (V).**




**The height of the boss is within tolerance if top of body (D) is between, or flush with, the step or end of pin (E).**

## Boss Height Inspected with Flush-Pin Gage

F. L. Rush, Woodbourne, N. Y.

A boss on a gear box top must be machined to a specified height to provide clearance for a gear-shaft assembly. To inspect this dimension, a flush-pin gage is used. The work *A* is supported by a ring *B* over a surface plate *C*. On top of the boss is the gage body *D* containing the pin *E*. One-half of the upper end of the pin is ground to form a step. The distance from the end to the step is made equal to the boss height tolerance.

Over-all length of the pin is such that when the work is on ring *B*, the step will be flush with the top of the gage body at the lower limit of the tolerance on boss height; and the end of the pin will be flush with the top of the gage body at the upper limit of the tolerance on boss height. A set-screw *F* in the side of the gage body is contained in a slot in the pin, and keeps both members together when the gage is handled.

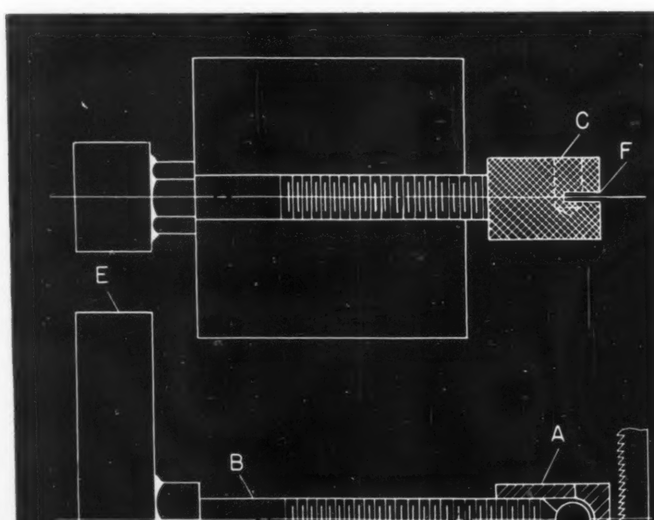
## Fixture for Slotting Balls on Band Saw

Robert Hill, Columbus, Ohio

Several dozen 3/8-inch metal balls were slotted through their center on a band saw, with the aid of a simple fixture.

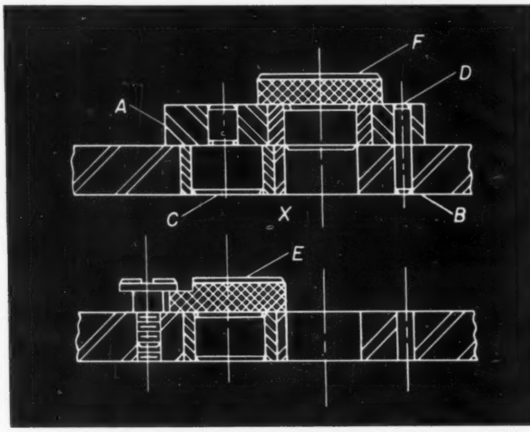
Balls were held in knurled cap *A* engaged to standard hexagon head bolt *B*. Quick loading and unloading was provided by hole *C*, slightly larger in diameter than the balls. To seat the balls properly, the inside of the cap had a large radius, and the end of the bolt, a conical recess.

A suitable base was provided by plate *D*, brazed to the body of the bolt. Handle *E*, brazed to the head of the bolt, was used to hold the fixture against the saw blade, which operated in channel *F*.




**To load or unload the fixture, cap (A) was loosened slightly until hole (C) was on top (for loading), or on bottom (for unloading).**

# SHOP KINKS




Auxiliary plate (A) aids production of closely spaced holes.

## Auxiliary Jig Plate for Closely Spaced Holes

H. J. Gerber, Stillwater, Okla.

Many times in the designing of jigs, bushing holes must be spaced so closely together that holes bored for liner bushings overlap one another. One simple solution to this problem involves the use of a small auxiliary jig plate seated on top of the main jig plate and containing the liner and slip bushings for the second hole.

The auxiliary jig plate *A* is positioned on the main jig plate *B* by means of two locators *C* and *D*. Locator *C* is a hardened and ground plug which seats in the liner bushing in the main jig plate and locator *D* is a standard hardened and ground dowel pin fitted in the same plate. Both locators *C* and *D* are made a press fit in the auxiliary jig plate and a slip fit in the main jig plate. Holes for dowel pin *D* are drilled and reamed on assembly after the small jig plate has been properly positioned. The dowel hole in the main jig plate is then lapped to fit the pin.

In use, the first hole in the work-piece is drilled and reamed through slip bushings *E* in the main jig plate. After the slip bushing used for reaming is removed, the auxiliary jig plate is installed as shown at *X* in the illustration. The second hole is then drilled and reamed through the slip bushings *F* in the small jig plate. A clearance hole provided in the main jig plate permits passage of the drill point and reamer. The sides of the auxiliary jig plate can be beveled in at the base to permit a finger grip for lifting.

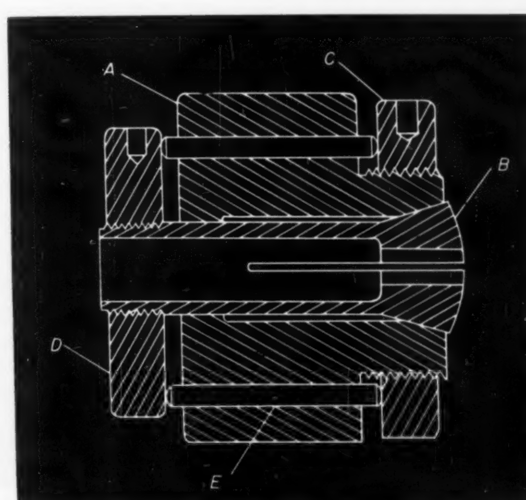
## Collet Holder for Eccentric Turning

Ernest Jones, New York City

Components requiring eccentric turning can be readily machined with the aid of the special chuck-mounted collet holder here illustrated. This device is held in a four-jaw lathe chuck and offset to produce the desired eccentricity. Multiple parts can be turned without resetting the collet holder in the chuck.

The cylindrical body *A* of the collet holder is bored to receive a collet *B* and is turned and threaded on the right-hand end for locking nut *C*. A second nut *D* is machined to fit the threaded end of the collet. Four push-rods *E* are retained in four holes drilled through the body as shown. Holes to accommodate spanner wrenches are provided in the periphery of nuts *C* and *D*.

After installing the proper size collet, the holder is clamped in a lathe chuck at the desired offset. A work-piece is then placed in the collet and locking nut *C* is tightened with a spanner wrench. The axial motion of the locking nut is transmitted to the collet by the push-rods and nut *D*. In this manner, the tapered end of the collet is drawn in the holder and the part is secured for the eccentric turning operation. Capacity of the device is limited by the sizes of the collets available, and the offset, by the proportions of the lathe chuck used.




Collet holder that is offset in a lathe chuck for eccentric turning of multiple parts.

# Plate Positioner Utilizes Gravity

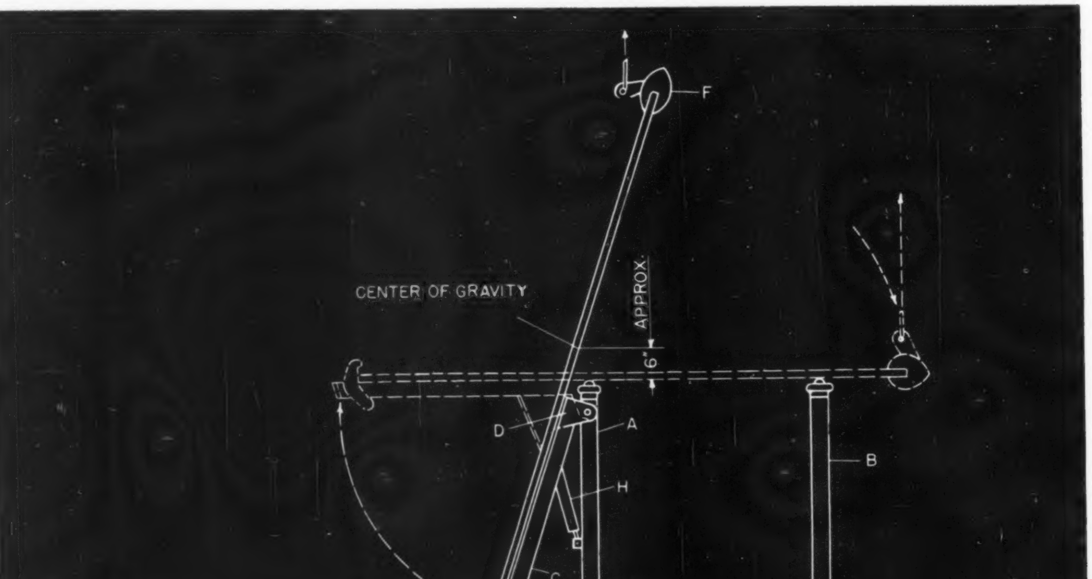
E. L. Sadowski, Cleveland, Ohio

Heavy plate, sheet, or other bulky flat stock can be transferred from a pit in which it is stored vertically to a press line along which it must move horizontally, with the aid of the labor-saving device illustrated. The plate is supported so that its own weight is used to flop it over from a near vertical plane to a horizontal plane at a predetermined height. Two or more of the units are arranged in tandem, depending on the length of the work involved.

Pipe post *A*, having a ball-bearing cap, is grouted in the concrete of the shop floor at the same height as other post conveyors, such as *B*, leading to the press. Tilt leg *C*, against which the work rests, carries hinge plate *D*, which is cross-pinned close to the top of the post. Length of the leg is such that its lower end touches the floor when the leg is at an angle of 15 to 20 degrees from vertical.

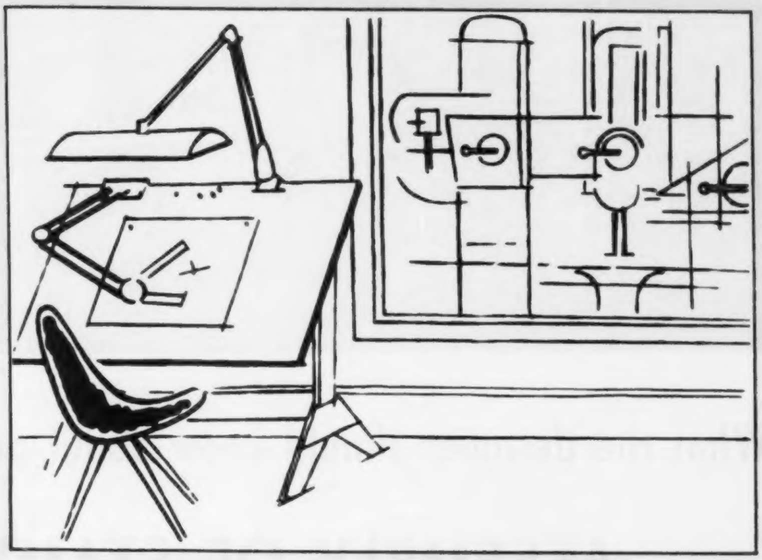
Foot *E* is adjustable along the leg according to the width of the plate: For each application, the foot must be adjusted so that the center of gravity of the plate is approximately 6 inches above the post.

In operation, clamp *F*, supported from an overhead hoist, lifts the plate from storage pit *G*, depositing it against the leg, with the bottom edge of the plate engaged by the foot, as illustrated. When the hoist then lowers the clamp, the plate and leg assume a horizontal position, as shown in outline, and the plate can be pushed onto the press line. Air cylinder *H*, linking the leg and post, prevents the leg from falling too rapidly, once the plate has been removed.




**Because the center of gravity of the plate is above post (A), the plate and leg (C) assume a horizontal position when the hoist lowers clamp (F).**

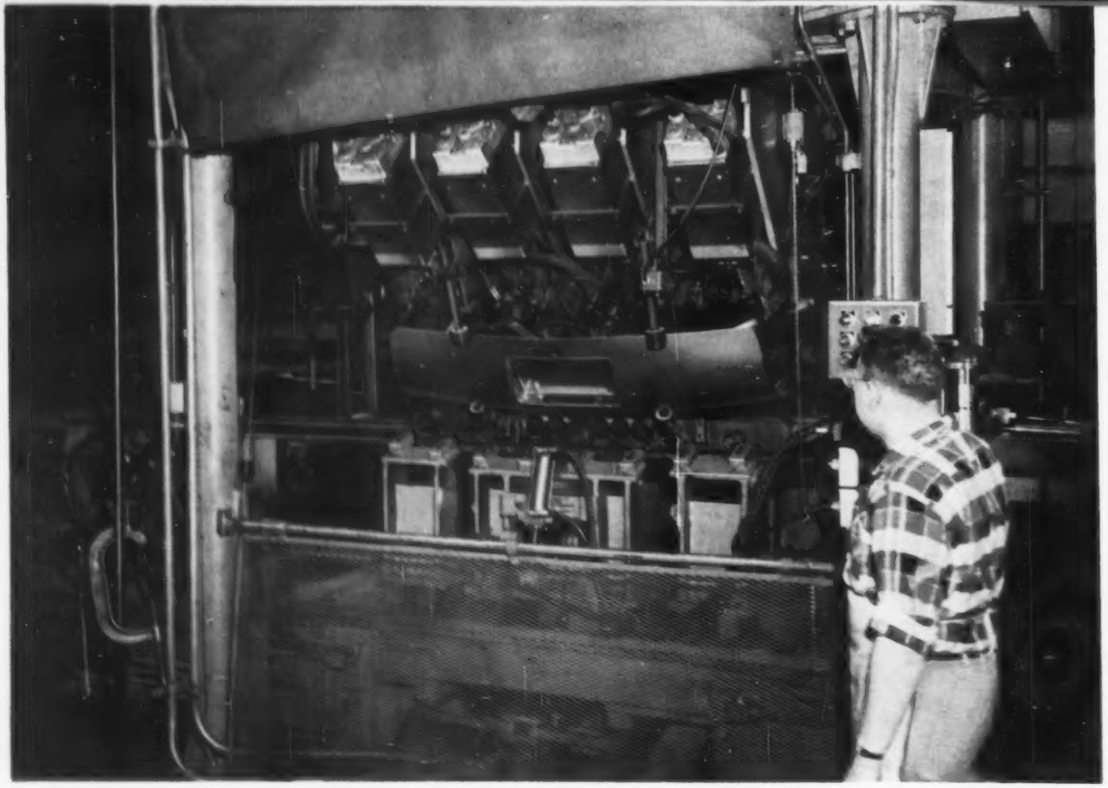
MACHINERY'S Reference Section



# WHAT THE DESIGNER SHOULD KNOW ABOUT PRODUCTION

## PART 7—ASSEMBLY OF STAMPINGS

April 1959



# What the designer should know about production—Part 7

# ASSEMBLY OF STAMPINGS

H. L. MacDOWELL
Staff Master Mechanics Office
Chrysler Corporation, Detroit, Mich.

IT IS INEVITABLE in the course of preparing sheet-metal production drawings that the engineer will become aware of many production processes. This is a good thing, especially in the automotive field, because succeeding engineering programs, taking acquired shop know-how into consideration, will run more smoothly and will result in better product and manufacturing designs.

**Economy and Quality**—Details of a preliminary design should be scrutinized from an economical viewpoint to head off unnecessary production costs. After analysis, any of the following changes may be recommended:

1. Reduce the number of multiple stampings to a minimum by combining details. This will save material, tools, and extra operations.
2. Alter the shape of a part to eliminate one or more operations and save related tooling.
3. Change the shape of a part or assembly to simplify tooling and/or equipment.
4. Alter the shape of a part to facilitate rapid production.

Next in order, but equally essential, is planning for quality in the items to be mass-produced. Quality may be described as that excellence of finish, surface smoothness, fit, alignment, etc., which meets specifications and which is pleasing to the discriminating buyer. In addition, the product must, of course, pass minimum engineering specifications for structural strength and functional requirements.

**Division of Operations**—The magnitude of a manufacturing concern will determine the fundamental character of its operation. In sizable operations, such as those undertaken by the large automobile manufacturers, one or more stamping plants will produce and ship both stampings and sub-assemblies to a number of final-assembly plants.

A stamping plant is essentially a high-speed manufacturing operation taking in sheet and coil

steel at one end and shipping out stampings and sub-assemblies at the other end. When completed, large panels, such as doors, continue on to welding presses and are assembled with other stampings. Individual assemblies are placed in shipping containers for delivery to the body-assembly plants. In planning for production, early determination must be made as to which assemblies will be fabricated in the stamping plant. Assemblies so selected should meet the following requisites:

1. They should consist of just those pieces which will make a compact unit. Final geometry should allow close nesting of duplicate parts for economical car loading.

2. They should not have protruding details which could be damaged in handling or shipping. It is best to ship these separately for later joining at the assembly plant.

3. Generally, assembly design must lend itself to high-speed machine welding methods, such as projection, seam, and press welding.

### *When Assembly is to be Done at the Stamping Plant*

Distinction between stamping and body-assembly plants should be fully comprehended by the design engineer because work to be joined by each type often requires different design treatment. To maintain body quality in the assembly plant, slip-joint weldments should be provided, whenever possible, in areas bordering openings. This will allow for any minor discrepancies found in detail panels and sub-assemblies. Although assembly fixtures will hold the parts in place while the joints are being welded, neither the fixtures nor the welding guns can overcome the effects of improper joint design.

In the stamping plant a considerable amount of assembly work is done on multiple-spot-welding presses such as the one shown welding a deck lid in the heading illustration. These units are used in a wide variety of sizes, some accepting entire automobile floor pans.

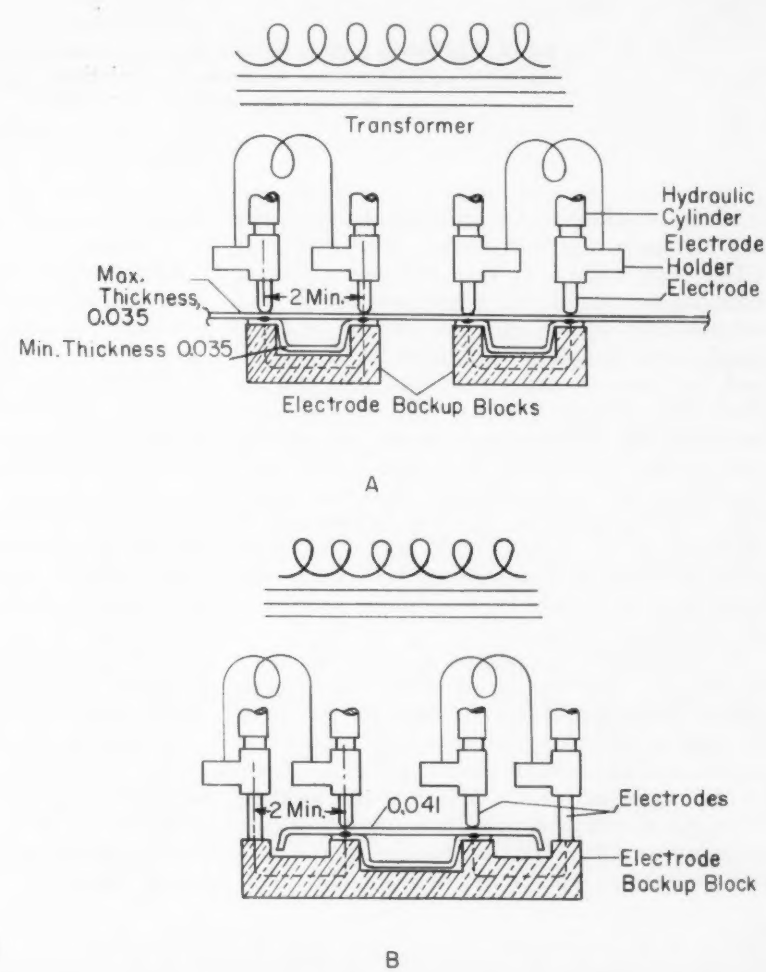
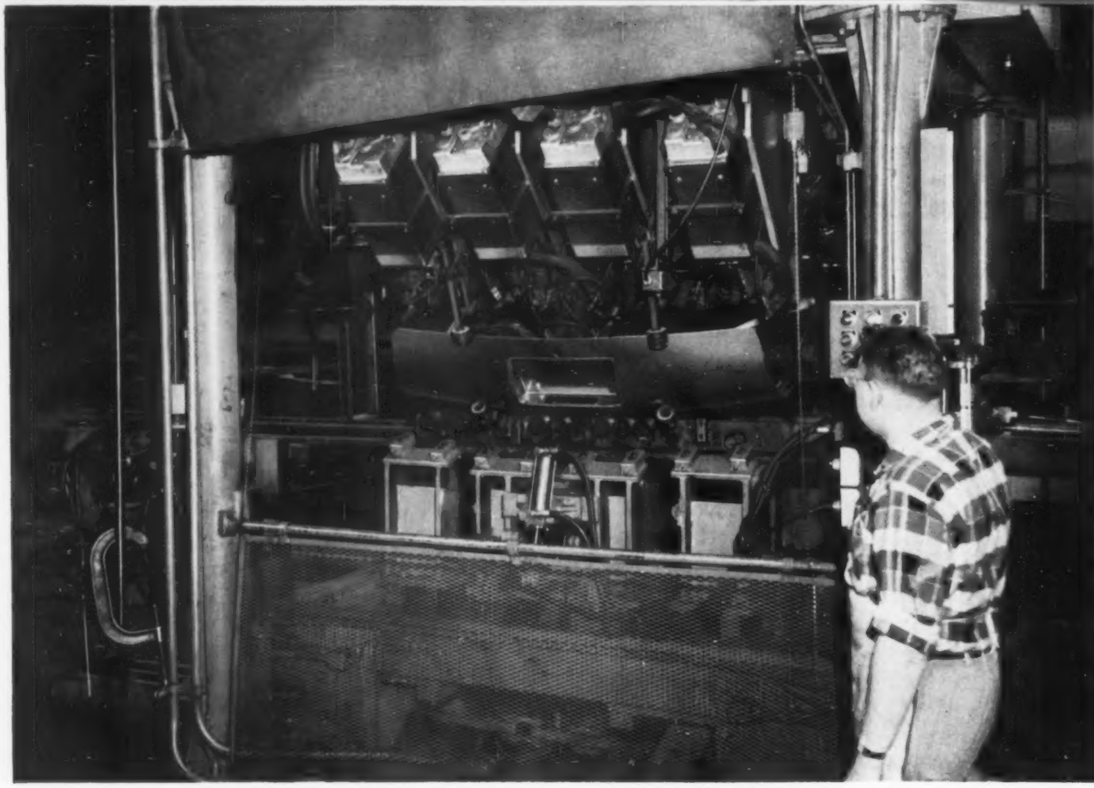



**Fig. 1. Welding setup in View A yields four spots per transformer and can be used if upper part is 0.035 inch thick or less. The welding method shown in View B yields only two spots per transformer, but is necessary when upper part thickness reaches 0.041 inch.**



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H. L. MacDOWELL
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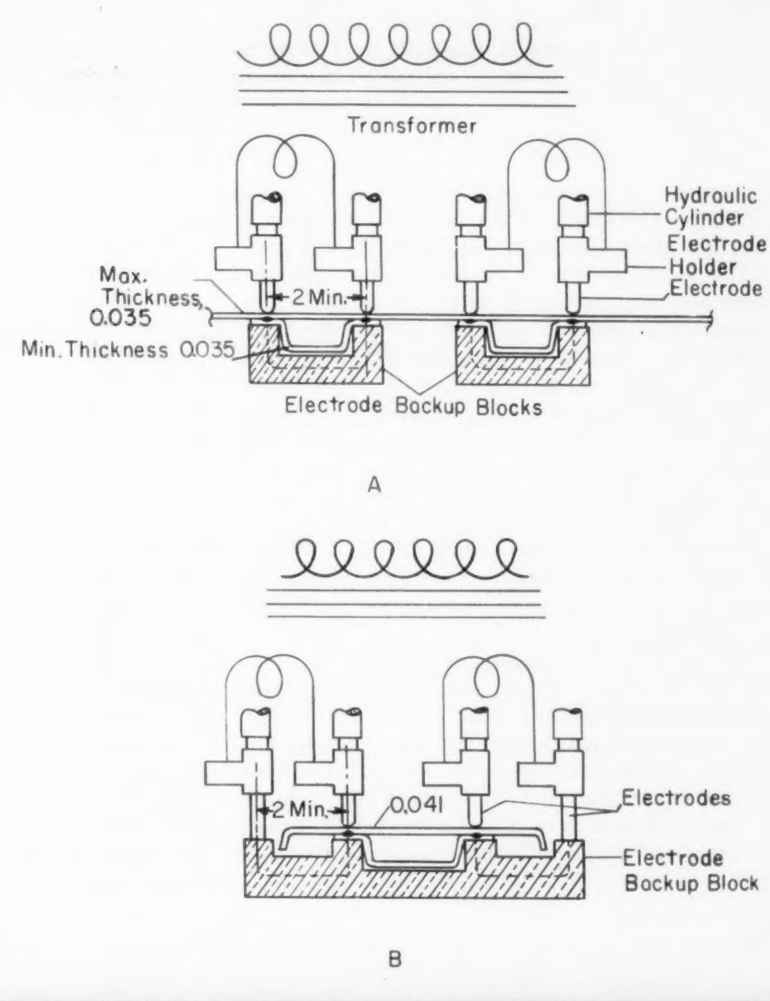



**Fig. 1. Welding setup in View A yields four spots per transformer and can be used if upper part is 0.035 inch thick or less. The welding method shown in View B yields only two spots per transformer, but is necessary when upper part thickness reaches 0.041 inch.**

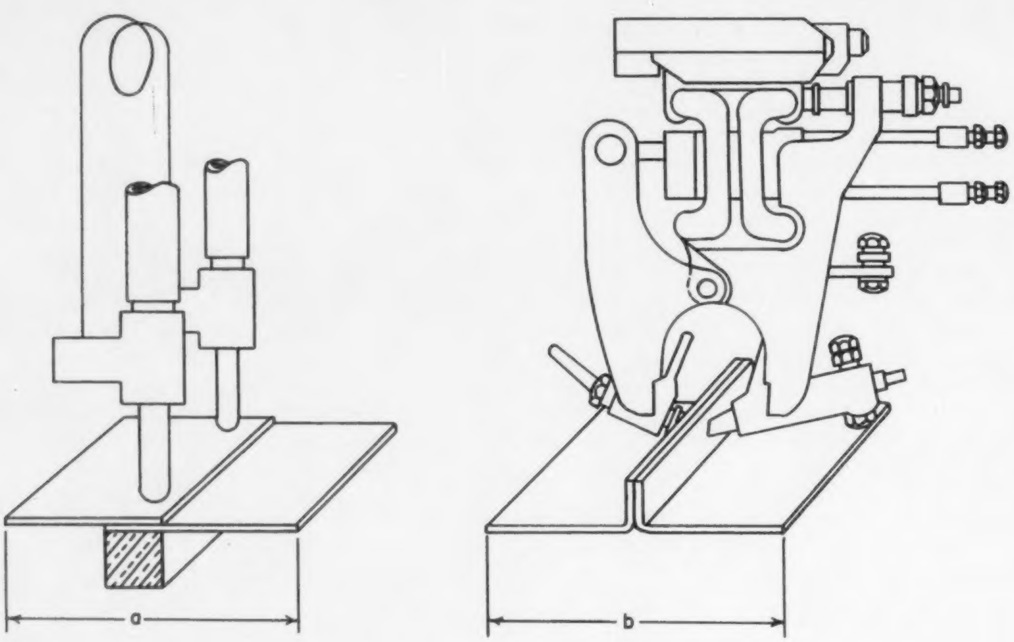



**Fig. 2. Lap joints, such as the one at A, can be handled with low-cost tooling in welding presses. As shown at B, relatively expensive tooling is necessary for coach, or pinch, joints.**

**Metal Thickness**—An economical press-welding electrode design is shown at A in Fig. 1. (The parts shown in this and the following sketches are intended to reflect foreseeable conditions—they do not represent current designs.) Small parts formed of steel, from 0.035 to 0.042 inch in thickness, can be dropped into nests in the backup blocks either manually or, preferably, automatically. The upper, or larger part is 0.035 inch or less in thickness. It is picked from loading rails as the lower electrode blocks are raised into welding position. Spacing between each electrode tip of a pair should be no less than 2 inches. Metal thicknesses used here permit the welding of four spots by the double secondary of each transformer.

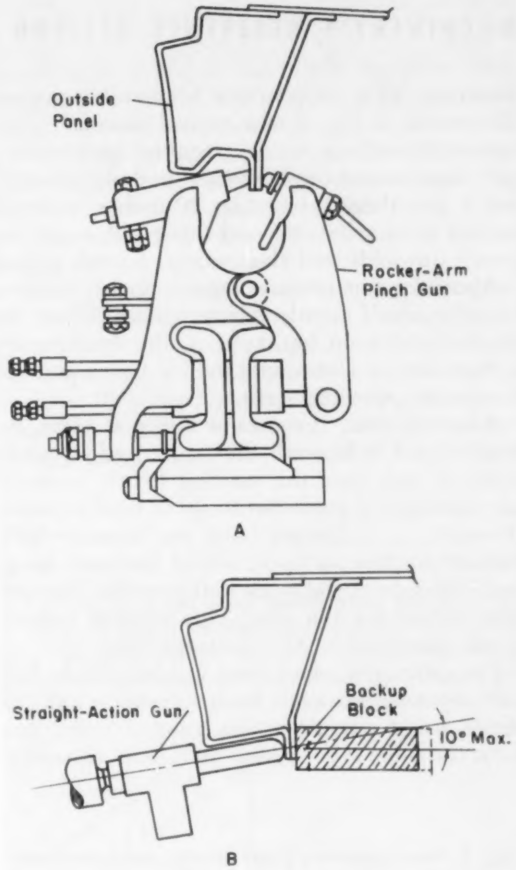
A second press-welding setup is shown at B. In this case the welding conditions have been altered somewhat. This stems from the fact that, for reasons of strength, the upper member is thicker, or 0.041 inch. Because the thickness limit for the upper part is 0.035 inch if the welding technique shown at A is to be employed, it was necessary to utilize different tooling for this second application. This is not as economical tooling-wise, as only two spots can be made by each transformer.

**Construction**—As a general rule, assemblies pass through welding presses in a horizontal position. For example, an underbody would be processed in car position, whereas a door would be handled approximately 90 degrees from car position. This simplifies mechanical handling, design of tools, and permits the press stroke to be held to a minimum—a factor normally affecting the production rate of the machine.

View A, Fig. 2, shows one portion of a multiple-spot press-welding operation on a typical lap joint. As can be seen, these joints lend themselves to low-cost tooling. Another advantage of the lap joint is that it permits the cancelling out of dimensional variations. Span measurement *a* can be gaged prior to welding, with variations in part widths disappearing into the lap joint.

In machine welding, coach, or pinch, joints (View B) are not recommended because of the relatively expensive tooling required. Furthermore, dimension *b* cannot be held closely due to the accumulation of tolerances of the two component parts.

Fig. 3. Comparison of poor and improved construction of a joint that must remain hidden from view. At A, a complicated rocker-arm type pinch gun is required; at B, a straight-action gun can be used.




Examples of poor and improved construction are compared in Fig. 3. In both these instances the lower weld joint must be held to a specific height relationship to the lower left-hand corner of the sub-assembly. The reason is that the left-hand stamping is an external decorative panel and the joint must not be visible. With the design shown at A, expensive tooling and a rocker-arm type pinch gun are required. It would be desirable, of course, to design out of situations like this.

Revised construction of the weldment is shown at B. Here, concealment of the joint flanges is less critical and simplified tooling can be employed. The outer flange is now accessible to a less-elaborate, straight-action welding gun, and a copper-alloy backup block is used against the inner flange.

When components of complex shape must be joined into a sub-assembly, costs can be held down by providing some form of self-location between the parts. Such a feature is incorporated into the design of the inner- and outer-sill sub-assembly shown in Fig. 4. "Thumbnails" integral with the inner sill serve as locating points for the flanged sections of the outer sill during welding. Built-in gaging points of this type should be used when it is not possible or practical to employ a fixture element.

### *Designing for Assembly-Plant Joining—a Different Outlook*

Mentioned earlier was the fact that a great part of the assembly work carried out in stamping plants is handled in multiple-spot-welding presses. Joints to be thus welded were, therefore, designed with this technique in mind. On the other hand, assembly-plant operations, for the most part, make use of portable welding guns, and of these the pinch type gun is more commonly employed. Just such an operation is shown in Fig. 5. This opens up a new field of special considerations for the designer.

**Joint Accessibility**—Ease of joint access for a portable gun is, in the majority of instances, sub-

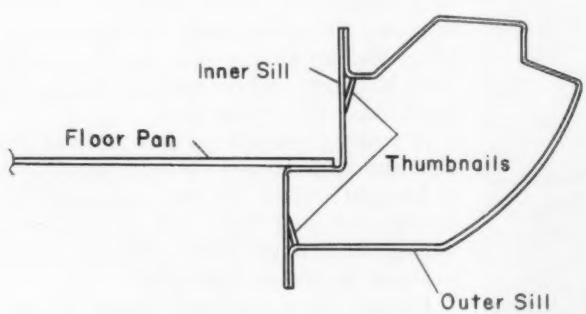



Fig. 4. Some method of self-location should be provided when members of complex shape are to be joined. In the sub-assembly shown, "thumbnails," integral with the inner sill, are used.

stantially different from that for welding presses. Illustrated in Fig. 6 is a typical assembly-plant operation calling for a portable spot-welding gun. One point brought out is that designs requiring a gun throat exceeding 20 inches in depth should be avoided. Beyond this point a gun becomes unwieldy and the quality of work suffers.

Another point is made regarding the positioning of parts of greatly different sizes. When the smaller part is on top, as at A, the operator has a clear field of view along the joint area and can accurately place the spots.

A reverse setup is shown at B, Fig. 6. Here, the smaller part is beneath the larger and is out of sight. In this case the holding fixture must be provided with a guide bar to aid in weld location. However, both designs have one commendable feature—the free, or open, side of the small flange faces the side of the work that provides the simplest access for the gun. This permits unhampered placement of the electrode tips.

For a stamping-plant press-weld electrode, lap-joint construction lends itself to economical tool design using straight-action guns. To the contrary, the same type of joint used in an assembly-plant operation requires, at best, an awkward, unwieldy gun.

**Fig. 6. Typical assembly-plant operation using a portable gun. With smaller part on top, as at A, operator has clear view of joint area. If reversed, guide bar is needed to locate weld line.**

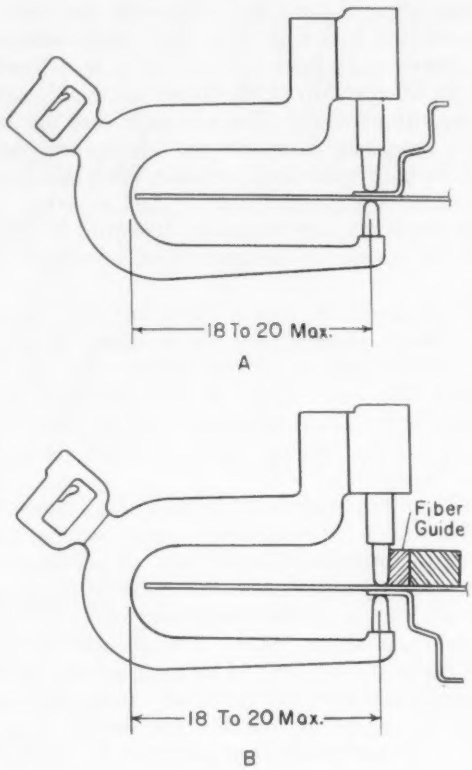



**Fig. 5. Most assembly-plant joining operations are done with portable welding guns. Here, a pinch type gun is being used on a body framing line to tack-weld a roof panel at the rear window opening.**

In the case shown at A in Fig. 7, the gun is further complicated because of poor access to the joint. It must be so constructed that it can be brought into the joint area while opened, and then closed into welding position. This tool, then, is costly. By redesigning the components to replace the lap joint with a coach, or pinch, joint as at B, a light and inexpensive pinch gun can be used along the entire joint.

A striking example of how tooling simplification can be achieved through joint modification is brought out in the two views in Fig. 8. Although the joint shown at A may seem logical enough at first glance, it presents a formidable obstacle to efficient welding.

Because of the difficult access to one of the panels in this construction, a special forged elec-

trode is required. The electrode is so shaped that the gun can be literally screwed into welding position. This gun is obviously expensive and the operation is slow. By simply redesigning the flanges in a downward direction as shown at B, convenient tool access is gained and a standard electrode can be used.

**Quality**—It is rudimentary that product quality exerts broad influence on consumer interest. This is especially true where aesthetic factors are concerned.

Does this bear on the subject of assembling automotive stampings? It does! Some of these stampings are large, comparatively flat panels of sheet metal. In a design such as the one illustrated at A in Fig. 9, the nearly flat panel indicated at *X* would likely develop loose metal areas, followed by buckling.

Offsetting the joint as shown at B will control this situation and will prevent deformation after assembly. A second solution is shown at C. Here, a crowned, or domed, surface eliminates the necessity of a jog in the panel.

Among the other factors influencing joint quality are electrode diameter and shape, applied electrode force, weld time, current intensity, weld spacing, and flange width or contacting overlap. Illustrated in Fig. 10 is an example of what can happen when spot welds are placed along a flange of insufficient width. Expulsion of

**Fig. 7. Although lap joints are preferred for press welding in stamping plants, they are generally undesirable for portable guns in assembly plants. Necessary tooling at A is awkward. Redesigned joint at B simplifies welding.**

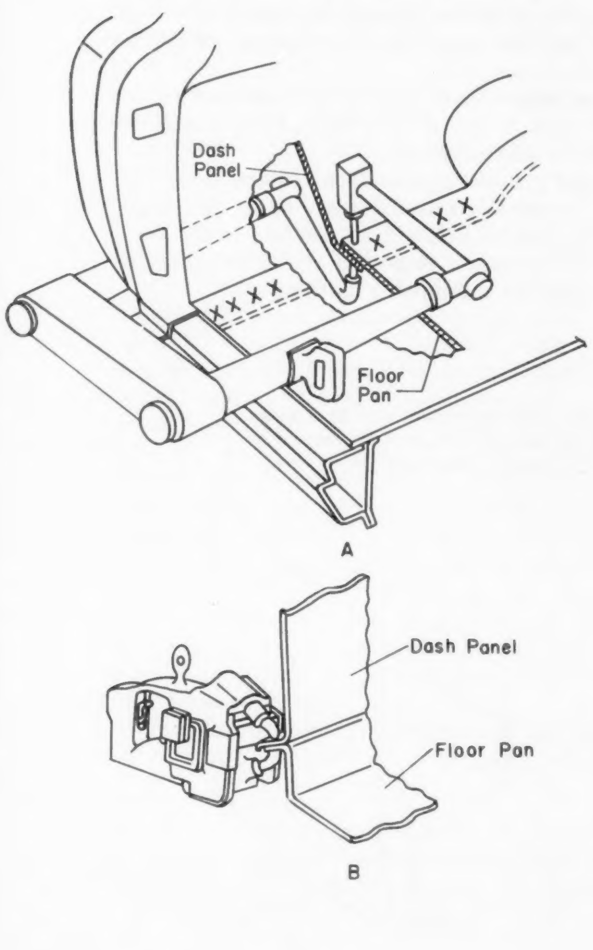
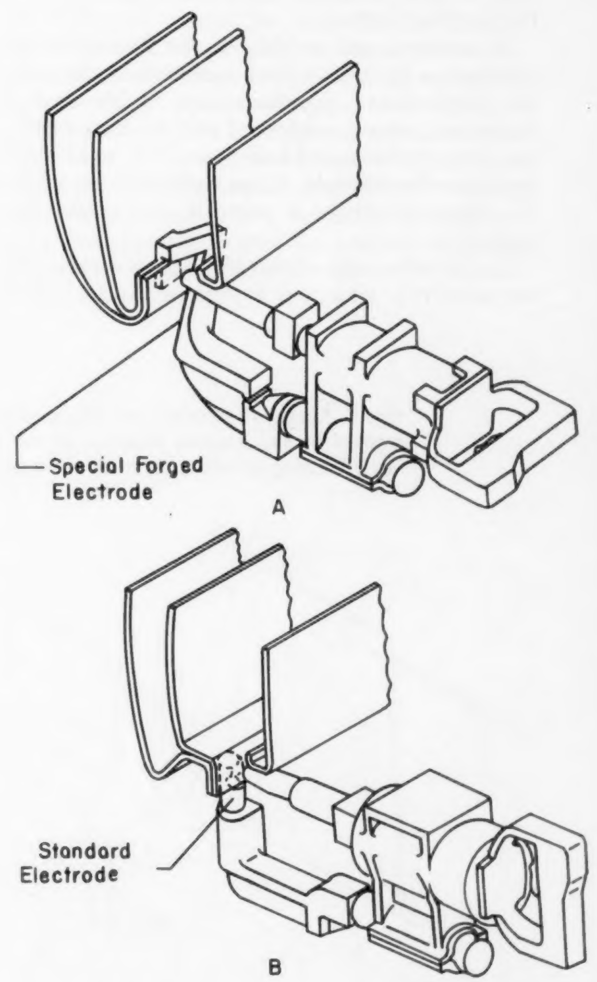



**Fig. 8. Slight joint modification can lead to a high degree of tooling simplification. Intricate, forged electrode is needed for welding the upturned flanges at A. Reversed flanges at B permit the use of a standard electrode.**



molten metal at the spots not only means additional hand grinding to remove the "whiskers" but, also, joint strength is adversely affected.

In Fig. 11 is shown an exterior-panel stamping to which a mounting bracket has been spot-welded. This represents poor design. In a short period of time the stresses acting through the bracket and the weld spots will create a dimple in the finished panel and will cause the paint to peel. The base metal will then be exposed to the atmosphere, permitting oxidation to set in. It is, therefore, apparent that assemblies should be so designed that structural members will not be welded directly to the exposed surfaces of any exterior-panel stampings.

### *Exterior Panels—Joints and Joining*

**Butt Joint**—This joint design is suitable for flash welding, gas welding, or inert-gas-shielded arc welding. The flash-weld method is the most limited in its application on exterior panels due to their modern styling. It is also a costly process that demands accurate joint matching, which is the limiting factor.

In contrast, gas welding is not limited in its application by any twisted condition of the panels. Furthermore, equipment cost is low and it produces a strong, reinforced joint because of the quantity of filler metal laid down. Gas welding is versatile—for example, it can weld parts to a hollow structure where a portable gun cannot be used.

On the other side of the ledger, gas welding is comparatively slow and expensive. Solder joints must be provided on exposed surfaces, thus necessitating costly finishing steps.

Inert-gas-shielded arc welding, like gas welding, can be used where twisted surface conditions exist. Equipment cost is reasonable and it produces a strong joint. The level of generated heat is low, resulting in little panel distortion.

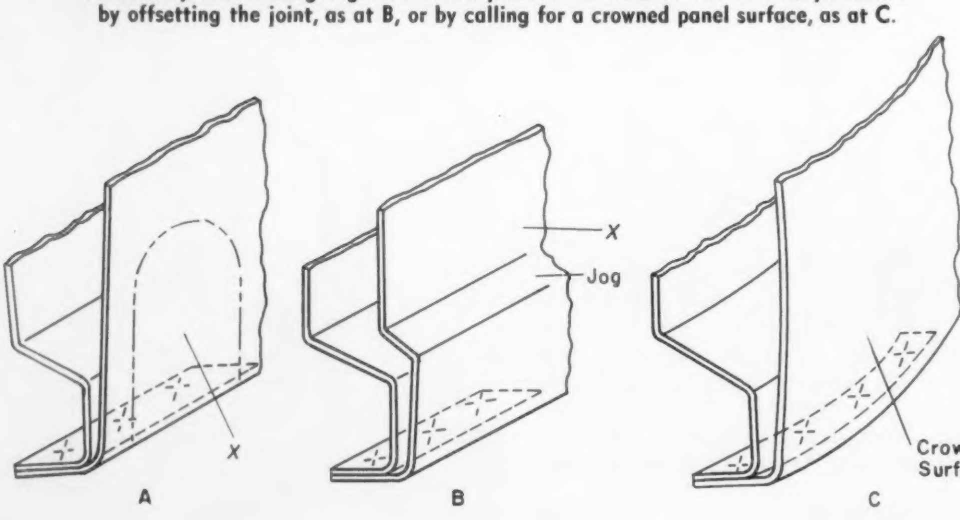
If the space enclosed by the inside surfaces of the two panels is large enough for a welding clamp, the welding may be done on the inside. A copper backup, slightly recessed, is then used to align the outside of the panels. This arrangement produces the weld bead on the inside and, as a result, it does not have to be ground down. The weld is stopped on the outside by the copper backup. The approximately 0.010 inch of weld protruding above the normal panel surface is readily removed with a disc or belt grinder.

There are some disadvantages to this method that should be mentioned. A better fit-up, or match, of panel trim lines is necessary here than for gas welding. Burrs on the trimmed panel that contact the copper backup should be removed to assure proper alignment. Preferably, the panel trimming operation should be planned so that burrs will be away from the backup of the assembly fixture.

**Lap Joint**—In exterior-panel construction, an offset type of lap joint is used. Both panels are offset for three reasons:

1. To provide against heat distortion;
2. To provide a shallow groove so that burns and buckles are below the finish line; and
3. To provide a recess for solder-filling of the joint prior to subsequent finishing.

**Fig. 9. Large, flat panel area (X), shown at A, may develop buckles due to stresses created by the drawing together of the parts to be welded. This can be prevented by offsetting the joint, as at B, or by calling for a crowned panel surface, as at C.**



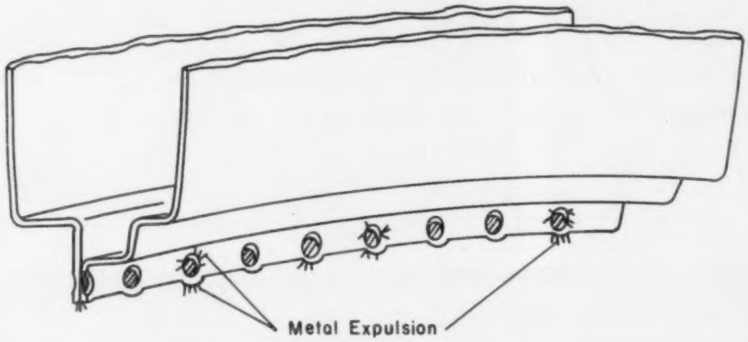



**Fig. 10. Metal expulsion is a likely result of placing spot welds along a flange of insufficient width. Not only is joint strength lowered, but hand grinding is sometimes necessary to clean up the area.**

Lap joints can be spot-welded in accessible areas with a portable gun, or can be handled in a multiple-spot-welding press. An inherent advantage of this type of joint is that it permits adjustment for production variations in the panels in a direction cross-wise to the joint. It can also be used on twisted surfaces. Accurate trim lines are not necessary. However, contour matching of mating panels is important. Fixtures are inexpensive: water-cooling and high clamping pressures are not required.

A drawback of the offset lap joint is that solder is usually required to seal the resulting depression, as well as to build it up slightly above the normal panel surface. It is then brought flush with portable grinders. However, if the joint can be located where it will be hidden by an applied molding, the panel offsets and subsequent soldering and finishing can be dispensed with.

**Coach, or Pinch, Joint—**This design is also suitable for spot welding or multiple-spot press welding of exterior panels. As most major panel joints are made in assembly plants, welding would be done primarily with a portable gun.

Fixturing is inexpensive—water-cooling and high-pressure clamps are not needed. A minimum of solder is required to seal the joint and build it up prior to finishing. If the styling scheme permits a crease in the panel at the joint line, soldering can be eliminated. In this case another sealer, such as a weld-through sealer, would have to be used.

One of the less-desirable aspects of the pinch joint is that it does not allow compensation for manufacturing variations. Flanges must match, and dimensions across the joint must be carefully controlled. By virtue of the bent flanges, the panels are, to a large degree, stiff. It is, therefore, difficult to bring them into alignment in the event of a mismatch of contours.

In summary, it can be said that the design engineer should thoroughly understand the difference between stamping-plant and assembly-plant operations, and should be able to conceive product designs based on proper consideration of their manufacturing requirements. More rapid development and acceptance of designs should result, thereby achieving the mutual objective of the design engineer and the product engineer —to plan for economical manufacture of a quality product.

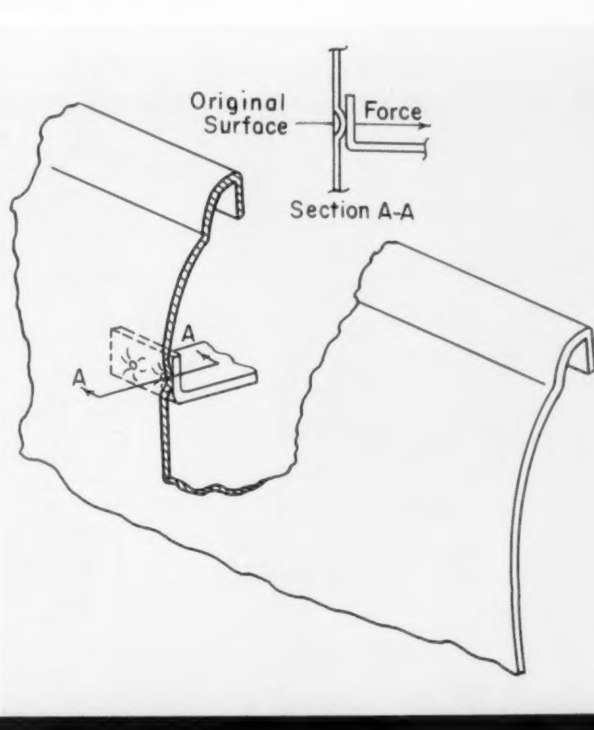
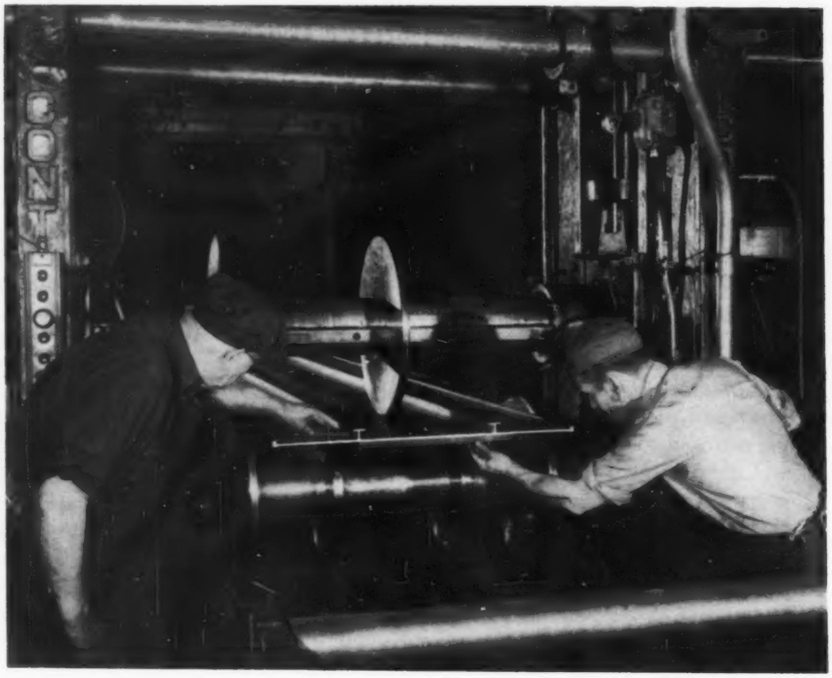



**Fig. 11. An instance of poor design is represented by welding a structural member directly to an exterior panel. Stresses acting through the bracket will create dimples, causing the paint to peel.**

# In Shops Around the Country

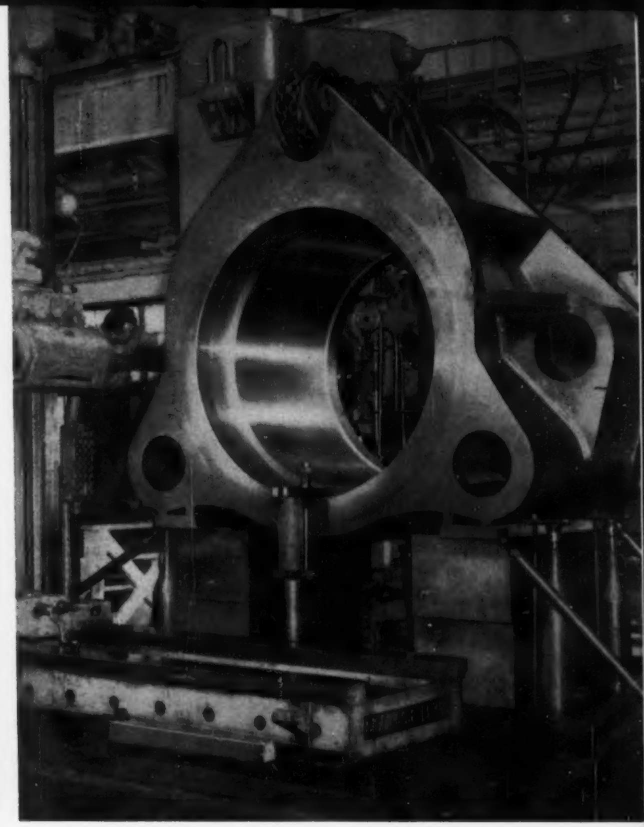
**Camera highlights of some interesting operations performed in various metalworking plants throughout the nation**

**TITAN SKIN** – An integrally stiffened extrusion for the exterior of the Air Force Titan is roll-flattened at Alcoa's Lafayette, Ind., works. The shape emerges from the extrusion press as a 20-foot-long inverted vee. The Titan is the nation's first ICBM having an aluminum skin. At the Martin Co.'s Denver division, stretch-forming, chemical milling, and welding operations are performed later.



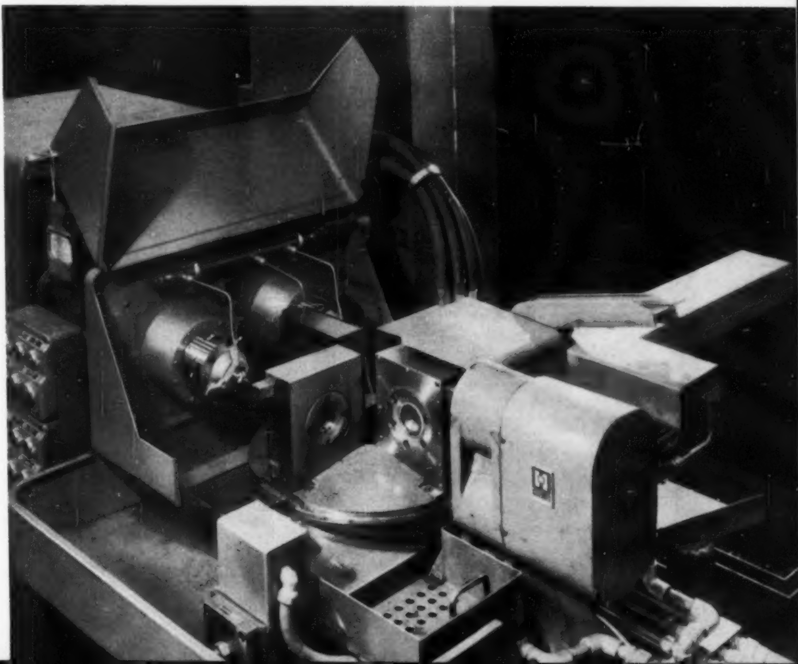
**HOT DUNKING**–A traction motor armature is lowered into a soldering pot at General Electric's apparatus service shop in Chicago. The pot has reduced the time required to solder armature coil leads to commutator bars by 50 per cent. More than fifty connections can be soldered in one operation within ten to fifteen minutes. Reservoir pot, in center, and electric immersion heaters for both pots were designed and built by the company's Industrial Heating Department, Shelbyville, Ind.

**AIR CLAMPING**—Kellering time for 200-pound, aluminum wing-beam forgings has been cut drastically at Chance Vought Aircraft, Inc., Dallas, Tex., by a company-developed, air clamping system. Each wing beam has its own set of clamps and valves. Handles of valves are painted different colors, keying them to certain clamps for quick identification. In moving between open and locked positions, the clamps automatically rotate 90 degrees.



**PRESS A-BUILDING**—A cylinder for a 3850-ton extrusion press for Harvey Aluminum will fit into this sleeve, being completed at the Torrance, Calif., plant of the National Supply Co. Central portion of sleeve was machined from a 19,320-pound forging. End plates were made from 5-inch steel plate, and ribs and curved sections from 3-inch plate. Approximately 2300 pounds of weld metal were required for assembly. Cylinder length is 109 1/2 inches.

**AUTOMATED BORING**—Precision boring, facing, and grooving from both ends of roll sleeves is a completely automated operation on a Heald Bore-Matic at the plant of Whitin Machine Works, Whitinsville, Mass. In loading, a hydraulic plunger inserts work from a chute into a collet chuck at one of the four stations of a rotary table. The new piece ejects the finished one into a tote bin. Table indexes 90 degrees, presenting the work to the first boring head, where one end is machined. Next index is to an idle position, then third index brings the work to the second boring head for identical operations on the other end of the part. Fourth index returns the work to the loading station.



# Numerically Controlled Tool Data Prepared from Written Specifications

A SIGNIFICANT IMPROVEMENT in the automatic control of machine tools that will increase the productive capability of American defense industry was demonstrated recently at the Massachusetts Institute of Technology, Cambridge, Mass. Known as the APT (Automatically Programmed Tool) system, the new technique uses a high-speed digital computer instead of men and desk computers to calculate the numerical data necessary to program the motions of a numerically controlled machine tool.

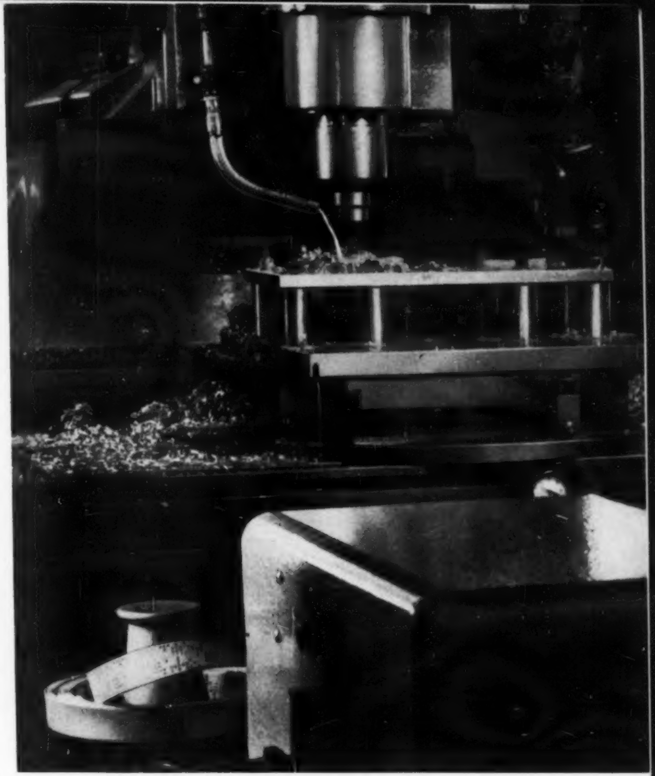
Key to the system is a relatively simple, English-like language used to communicate part descriptions and machining sequences directly to the computer. Although this language has been designed primarily for the convenience of the human programmer, it can be translated and understood by the computer. The language permits people with no knowledge of computers to control complex calculations.

From a working drawing, a part programmer writes a general outline of the machining sequence to be followed in simple APT language. These directions are then punched on cards which, in turn, feed the problem to the computer. Ordinarily, a general-purpose computer could not understand these directions but, by first reading in a master deck of program cards, it is effectively transformed into a specially designed APT computer. It then transforms the general information supplied by the programmer into the necessary detailed instructions which are coded on machine-control tape.

A typical step in a machining sequence as written in "APT language" might be "ON KUL, ON SPN, GO RGT, TL LFT, CIRCLE/CTR AT, +2, +3, RADIUS, +5." Translated, the sentence says, "Turn on the coolant, turn on the spindle, go right with the tool on the left side along the circle whose center is located at x equals 2, y equals 3, with a radius of 5." There are currently 107 words in the special vocabulary, but it is expected to be increased to approximately 300.

The APT technique was developed at M.I.T.'s Servomechanisms Laboratory over a two-year period marked by close cooperation with the aircraft industry and the United States Air Force. Research funds have been furnished under contract with the Air Force's Air Materiel Command. Nineteen member plants of the Aircraft Indus-

**Group of small parts that have been manufactured on numerically controlled machine tools at Convair, Division of General Dynamics Corporation, Fort Worth, Tex. All were programmed with the aid of a large, general-purpose digital computer.**



**Punched tape (left, foreground) feeds information to the vertical milling machine (rear) as part is machined under the APT system. Holes in the punched tape were cut from directions furnished by a large digital computer.**

tries Association have, on their own initiative, contributed funds for continuing development of the system.

Two important advantages can be attributed to the APT system. First, its unique language has been designed so that a standard procedure can be utilized throughout the aircraft and missile industry. Second, the system has been designed for future growth to accommodate more complex parts and further reduce human effort. It contains what is called a "general skeleton program representing a systematized solution to the problems of moving a cutting tool in space." The skeleton program can be "fleshed out" for any particular application by adding to it the cutting directions for each surface involved so that a specialized computing program may be made for the particular problem.

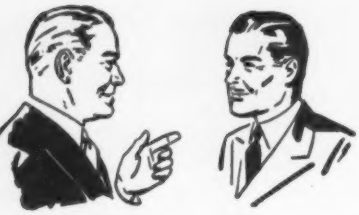
Although the APT system, in its present state of development, has not completely eliminated the need for manual programming, a year-long period of field trials by AIA companies, plus research at M.I.T., has indicated that a significant portion of parts now being manufactured can be produced using the present system. Further refinement of the system is aimed at the complete elimination of manual programming. A hint of the technological breakthrough in programming complex part shapes is typified in the example of such a task for a wing-rib shape. Two hundred man-hours were required to program this part manually. Only five hours were necessary to do the same job by the APT-computer method. Man-hour reductions of from 80 to 95 per cent can be expected.

Cooperative effort for refinement and development of the current system will be managed by the APT Project Coordinating Group of AIA's Numerical-Control Panel, which operates under the association's Technical Service Section. The program provides for participation by qualified and equipped non-AIA members. Prerequisites for participation are possession of, or access to, a suitable computer and a willingness to accept and execute task assignments from the coordinating group. It is forecast that a two-year program will be necessary to accomplish specific refinements of the APT system.

Present scheduling calls for early release of the remainder of the APT documentation prepared by M.I.T. under Air Force contract. These data will consist of six separate volumes with a total of more than 600 pages of text, diagrams, and charts. Initial distribution will cover participating AIA member companies, as well as industrial concerns and research organizations.

# Instrument Optically Determines Crystal Alignment

A new instrument allows rapid and accurate orientation of silicon and germanium crystals for slicing, dicing, and alloying operations. The device has been developed by Sylvania Electric Products Inc. to facilitate the manufacture of semiconductors. These devices have a tiny die of silicon or germanium with "zones" or layers of differing electrical properties formed by alloying minute quantities of special metals, such as indium or antimony, into the crystal structure. The instrument utilizes a converging beam of light projected upon microscopic etch pits in the surface of the material. The beam is reflected from the facets of the etch pits and split into a number of component rays equal to the number of planes comprising a single pit. The planes behave like tiny mirrors and reflect these component rays to a screen. From the light pattern formed the operator can immediately determine the orientation of the crystal.



# Talking With Sales Managers

**BERNARD LESTER**
**Management Consulting Engineer**

## The Fourth Leg of the Table

THE POWER of conversation in affecting buying opinion when applied within business circles is well recognized, but its influence at social events and elsewhere is often overlooked. In one instance, just a stray remark on the need for new shop equipment to enable a plant to handle a large pending order for automobile parts, led one machine tool builder's sales department to get a head start on competitors.

Every machinery sales manager today should be concerned with making each employe of his company realize the advantages of taking an interest in sales. This interest can be promoted by helping employes to know more about sales and to understand how selling helps everyone.

Sometimes the main hindrance to involving *all* employes in selling is a "hands off" policy by a secretive sales department. More often this department does not win the good will and interest of other employes because it doesn't explain to them what selling is, what salesmen do, and how a combination of forces beyond the salesman himself can make or break sales.

In several cases, we know of sales managers who have been well rewarded by "selling" every employe on selling. Of course, the sales department can't invade other departments with a brass-band parade. But those in charge of industrial relations cannot alone do the trick, even though they can well lead the way to a better understanding of the necessity for sales.

The following philosophy is used successfully by one company—it is based on a recognition that every employe should know how the company functions, and that the work of the sales department is so often misunderstood: The machinery builder is like a stout table supported by four legs —Finance, Design, Production, and Sales. These legs can never hold up a growing volume of profitable business without certain connecting braces, such as Management, Procurement, and Personnel Relations, which tie all legs together.

It is futile to argue which leg or brace is most important. Take one away and the table tips over. But you can visualize the nature of one "leg" more easily than another. For instance, we can study the anatomy of Design by picture, print, or specification. We can witness the drama of Production by going through the shop. Finance offers many kinds of figures to dig into. But when it comes to Sales, an order is only a slip of paper.

A young man told me he wanted to be a sales engineer.

"Why?"

"Because I like to travel, move among lively people, and entertain. I would get a big kick out of bringing home a good order."

How foolish! Selling today is not sailing through the blue with a shoe-shine and a fat billfold.

This young man didn't know that:

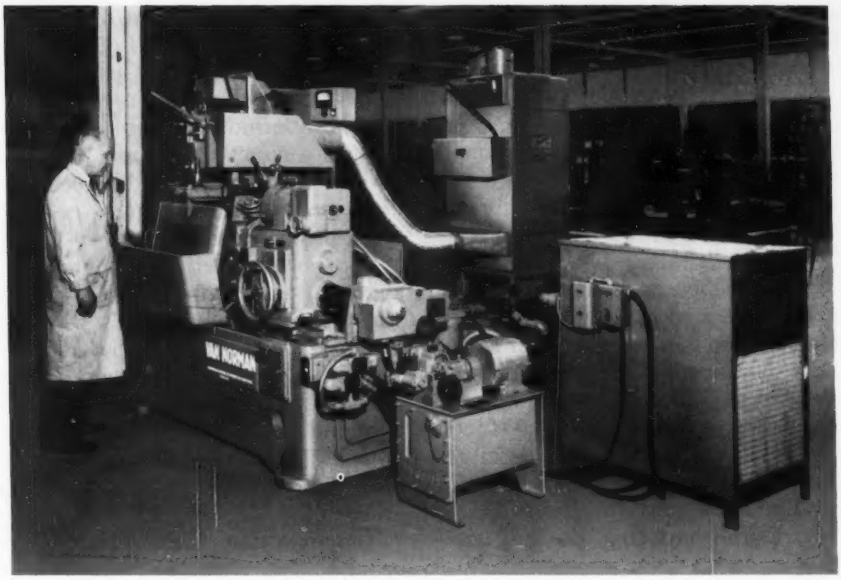
> Selling may demand attentive effort any hour in a twenty-four-hour day.
>
> Sales engineers must go "where and when" they are disinclined.
>
> People don't want to see a salesman unless he can help them.
>
> Though neat and clean, the sales engineer must be ready to get dirty.
>
> Economy applies to selling just as much as to manufacturing.

When we stop to think, five reasons rise above all others to lead prospects to buy from the successful vendor.

> The product is well designed and built.
>
> The commitments are competitive and consistently met.
>
> The business transactions are pleasant, prompt, intelligent, and clean.
>
> Customer interest and service performance are always constant and alert.
>
> People of all callings and in all walks of life speak well of the vendor's company.

Today, the equipment salesman is a cost-conscious application engineer. He must understand his prospect's technical and economic problems. He must calculate dollar results.

Have you such a philosophy in action, so that you will tell employes what selling is and what salesmen do? Are you getting their support?



# Crush Forming Speeds Infeed Centerless Grinding

**Approximately 0.185 inch of stock is removed in eighteen seconds by means of this rough-grinding setup. About 600 work-pieces can be ground before crush forming the abrasive wheel.**

AUTOMOTIVE power-steering components—the dimensions of which are shown in the accompanying drawing—are being ground to finished size from cutoff lengths of bar stock in only two operations. The operations are performed on Van Norman No. 2C Diversimatic centerless grinding machines arranged for infeed grinding and crush forming.

The parts are made from La Salle "Fatigue-Proof" steel bar stock, 0.396 inch in diameter. This material has a tensile strength in the range of 140,000 to 160,000 psi, a yield strength of 125,000 psi, and a hardness of 30 to 36 Rockwell C—without the need for heat-treating. The two surfaces that are 0.3800 to 0.3805 inch in diameter, the center section (0.200 to 0.201 inch in diameter), the two connecting fillets (0.35 to 0.36 in radius), and the 45-degree chamfer on one end are all ground in both the roughing and finishing operations.

Originally, it was thought that the parts should be ground in three operations: first, through-feed centerless grinding to remove surplus material; then, infeed centerless grinding of the center section and adjoining fillets; and, finally, finish-grinding of the entire part to final size with a diamond-dressed formed wheel. However, it was found possible to rough- and finish-grind the entire part, using crush-forming of the abrasive wheel for both operations. This eliminated the need for a through-feed operation, and the possibility of runout between the 0.201- and 0.3805-inch diameter surfaces in the rough-grinding operation. By grinding all surfaces simultaneously in both the roughing and finishing operations, eccentricity is kept at a minimum.

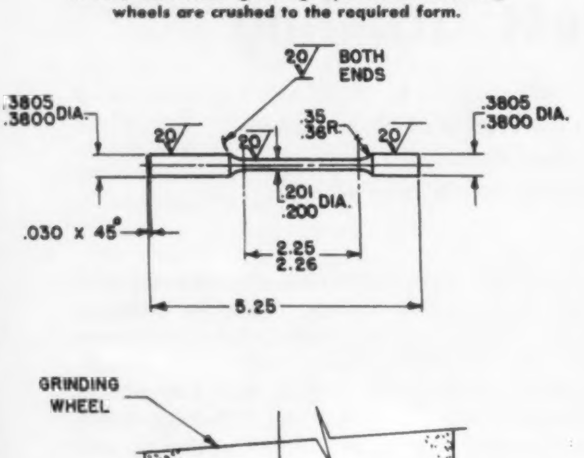
In the rough-grinding operation, which is completed in eighteen seconds, the center section of the blank is reduced in diameter to 0.211 inch—a stock removal of approximately 0.185 inch on the diameter. This represents a stock removal rate of 0.018 inch per second, the remainder of

the cycle being required for loading and unloading. A stock removal rate of 0.001 inch per second has been common practice for infeed centerless grinding. Total stock removal from all surfaces in rough-grinding is about 0.240 cubic inch, representing a stock removal rate of approximately 0.023 cubic inch per second.

A vitrified-bond, aluminum-oxide abrasive wheel of 220 grain size, P grade, and open structure is used for rough-grinding. The wheel, when new, measures 24 inches in diameter and is 6 inches wide. It is operated at a surface speed of approximately 6000 feet per minute. After rough-grinding about 600 work-pieces, the abrasive wheel is crush-formed. Each crush forming reduces the diameter of the wheel about 0.004 inch.

The crush-forming unit is mounted in the wheel-spindle housing, with the crush roll being hydraulically positioned and mechanically fed into the wheel. During crushing, the roll is rotated at 100 rpm and a total pressure of 3000 pounds (nearly 600 pounds per lineal inch) is applied. The roll is made from Crucible Steel Rex AA, an abrasion-resistant, 18-4-1 high-speed steel that is hardened to 64 Rockwell C and ground. After the roll has been used to crush-form the abrasive wheel about thirty times, it is reconditioned by grinding. Each reconditioning reduces the roll diameter by about 0.001 inch, and the roll has a life of at least 100 reconditionings. This represents a production of nearly two million work-pieces per roll.

**Part shown at top is ground from bar stock in two infeed, centerless grinding operations. Grinding wheels are crushed to the required form.**




A rubber-bonded abrasive wheel, 12 inches in diameter and having an 80 grain size, is used as the regulating wheel. This wheel, which has a variable-speed drive, is operated at 20 rpm, and is trued twice a day by a hydraulically operated, cam-controlled, diamond dressing attachment. A diamond dresser is also provided for the grinding wheel. This is used to rough out the required form on a new wheel, thus saving wear on the crush roll.

The same type of abrasive wheels are used for grinding and regulating in the finishing operation, with the exception that the grinding wheel is of 320 grain size. About 0.010 inch of stock is removed in this operation, which only requires nine seconds. The finish-grinding wheel is crush-formed after completing about 3000 parts. A specified surface finish of 20 micro-inches is easily obtained.

Spindles for both the grinding and regulating wheels are of unit type construction, totally enclosed with anti-friction bearings to minimize deflection during crush forming, which might result in out-of-round parts. The automatic cycling unit on the centerless grinders is electrically controlled and hydraulically actuated to insure constant cycle time.

A high-sulphur content mineral oil, having a Saybolt viscosity of 200 seconds at 100 degrees F., is used as the grinding fluid. The cutting oil is continuously circulated through a magnetic separator made by Commercial Filters Corporation, the oil passing over a magnetic drum which removes metal chips and other ferrous particles. Non-magnetic particles settle out, and the separator tank is periodically cleaned.

Clean oil is recirculated through a Lindholm chilling unit, which maintains the temperature of the oil at 55 degrees F. By keeping the heat at a minimum, no warm-up period is required when starting the machines. A Westinghouse Precipitron control unit has also been provided to remove oil mist and smoke from the air. Oil-laden air is drawn from around the grinding operation and passed through a filter which strains out chips and abrasive particles. Also, the oil-mist particles are electrically charged, attracted to collector cell plates, and accumulated in a sump for re-use, while clean air is returned to the shop.

# MACHINERY'S PROBLEM CLINIC

**Mathematical problems in shop work and tool design submitted by readers of MACHINERY**

**Edited by HENRY H. RYFFEL**

## Bend Allowance Facilitates a Trigonometric Solution

BERNARD PACKER

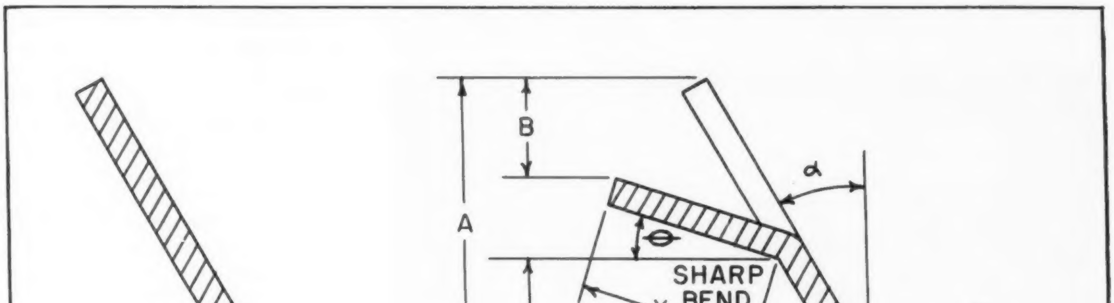



**Fig. 1. The sheet-metal part at the left is to be lanced and bent as shown at the right.**

The sheet-metal part shown at the left in Fig. 1 is lanced and bent in a subsequent operation to the dimensions shown at the right. It was required to calculate dimensions $X$ and $Y$, using $A$, $B$, $T$, $\alpha$, and $\theta$, which are known.

SOLUTION:

1. Referring to Fig. 2, the length of lancing is $C + X$, $C$ being the bend allowance for a bend angle of $90° - (\alpha + \theta)$. Values for bend allowance are given in MACHINERY's Handbook and other reference works.
2. $D = T \sin \alpha$
3. $E = T \cos \theta$
4. $F = (C + X) \cos \alpha$
5. $G = X \sin \theta$
6. $F = B + E + G - D$
7. Equating (4) and (6),
$$(C + X) \cos \alpha = B + E + G - D$$
8. Substituting $G = X \sin \theta$ from (5) in (7),
$$(C + X) \cos \alpha = B + E - D + X \sin \theta$$
9. Solving (8) for $X$,
$$X = \frac{B + E - D - C \cos \alpha}{\cos \alpha - \sin \theta}$$
10. With $X$ known, the value of $G$ in (5) can be determined. Then,
11. $Y = A - (B + E + G)$

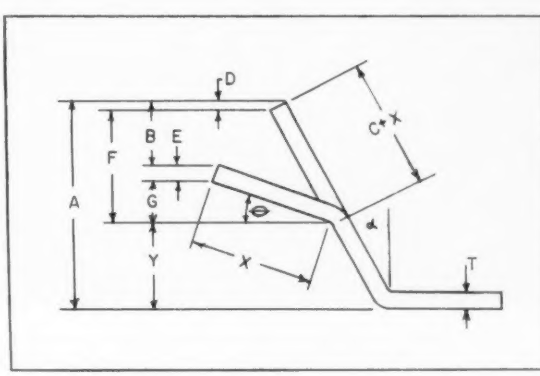



**Fig. 2. Dimensions X and Y are calculated using the other dimensions shown.**

# LATEST DEVELOPMENTS

**Machine tools, unit mechanisms, machine parts, and**

## Lodge & Shipley Floturn "Chipless" Metal-Forming Machine

The Lodge & Shipley Co., Cincinnati, Ohio, has just announced a No. 12 vertical Floturn machine developed for "chipless" metal-forming of high production parts ranging up to 16 inches in diameter and 15 inches in length. This unit is new in virtually every feature, yet it operates on the same principle incorporated in the series of Floturn machines introduced in 1952 by Lodge & Shipley. The equipment features an automatic cycle which may include automatic loading and unloading. The vertical design, as shown in Fig. 1, incorporates radially opposed "Dual-Sincro" rollers which may be seen in Fig. 2. These rollers have been designed to eliminate deflection and assure extreme accuracy. Automatic hydraulic tracer control is provided to make production of complex shapes a "push-button" operation.

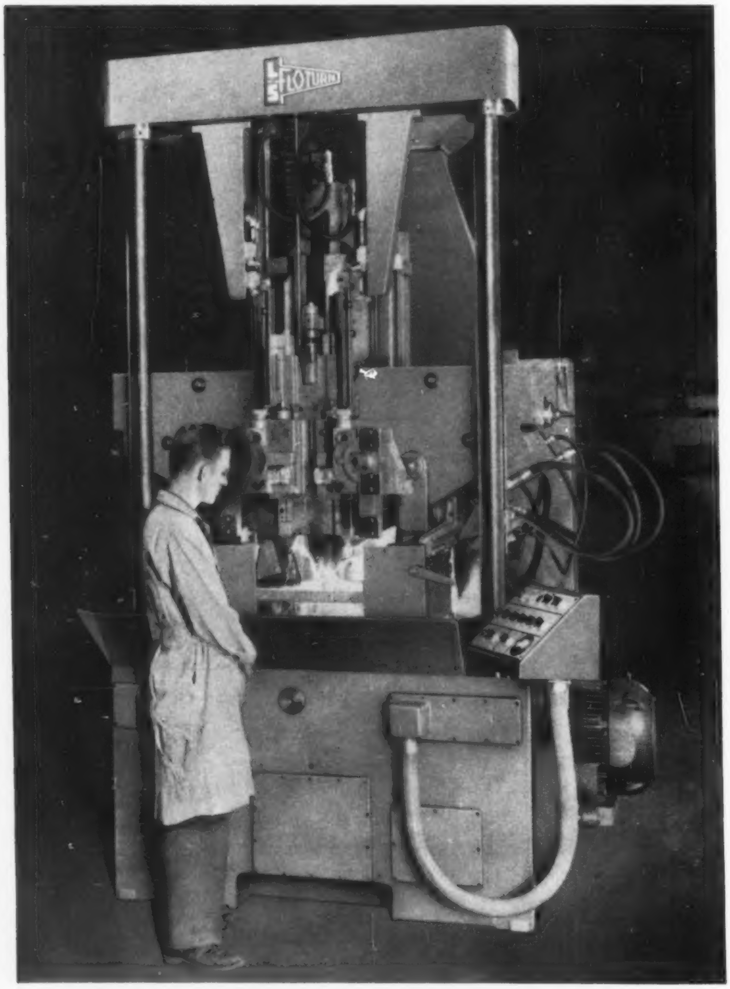


Fig. 1. Lodge & Shipley vertical Floturn machine for "chipless" forming of parts up to 15 inches in diameter

The new machine produces conical, cylindrical, contoured shapes or combinations of these shapes, such as shown in Fig. 3, from flat blanks, preformed blanks, or machined blanks, working virtually any suitable metal or alloy with exceptional speed and ease. Among typical aircraft and missile, ordnance, scientific, and houseware parts already produced are: stainless missile nose cones, copper charge cones, alloy-steel motor mounts, stainless and aluminum mixing bowls, and stainless engraved beakers.

The "Dual-Sincro" roller trade name indicates that the metal-flowing rollers are synchronized; they work in the same plane, opposed to each other to eliminate deflection. The spelling of "Sincro" also denotes that the machine works on the sine law (where the sine is the instantaneous angle between the center line of the spindle and the tangent to the contour at the point of roller contact). Among other advantages claimed by the manufacturers for this No. 12 vertical Floturn is the accessibility of the working area, which makes manual loading and unloading much easier and faster. A skilled operator is not required. Setup work has been radically simplified so that a representative job can now be set up in as little as forty-five minutes.

A unique operational feature incorporated in this machine is automatic compensation for variations in blank thickness. It is said that variations of as little as 0.003 inch may result in unacceptable workpieces when no compensation is

# IN SHOP EQUIPMENT

## material-handling appliances recently introduced

Edited by FREEMAN C. DUSTON

made for such variations, particularly on thin-wall pieces. An inter-relation between the machine's ram (which holds the work-pieces) and the template supports automatically adjusts template position to compensate for the smallest practical variation in blank thickness.

The Floturn machine has proved very useful for research and development work in the missile field. It can also be used in the experimental production of prototype parts and scaled-down models of larger parts. The machine consists essentially of a base containing the spindle and spindle drive with the spindle arranged to take mandrels (tooling) for particular jobs; lubrication reservoirs and pumps; and coolant tank and pump with accessories. The column, rising from the base which has ways for the carriage and ram, also contains the carriage counterbalance. The ram carries a built-in live center to receive the spindles suitable for various work-pieces. The carriage has two synchronized and hydraulically actuated roller slides with easily replaced rollers, the action of the rollers in forming the part being tracer-controlled by individual templates. Provision is made for a wide range of adjustments.

At the beginning of the auto-

Fig. 2. Group of typical parts produced on Floturn machine

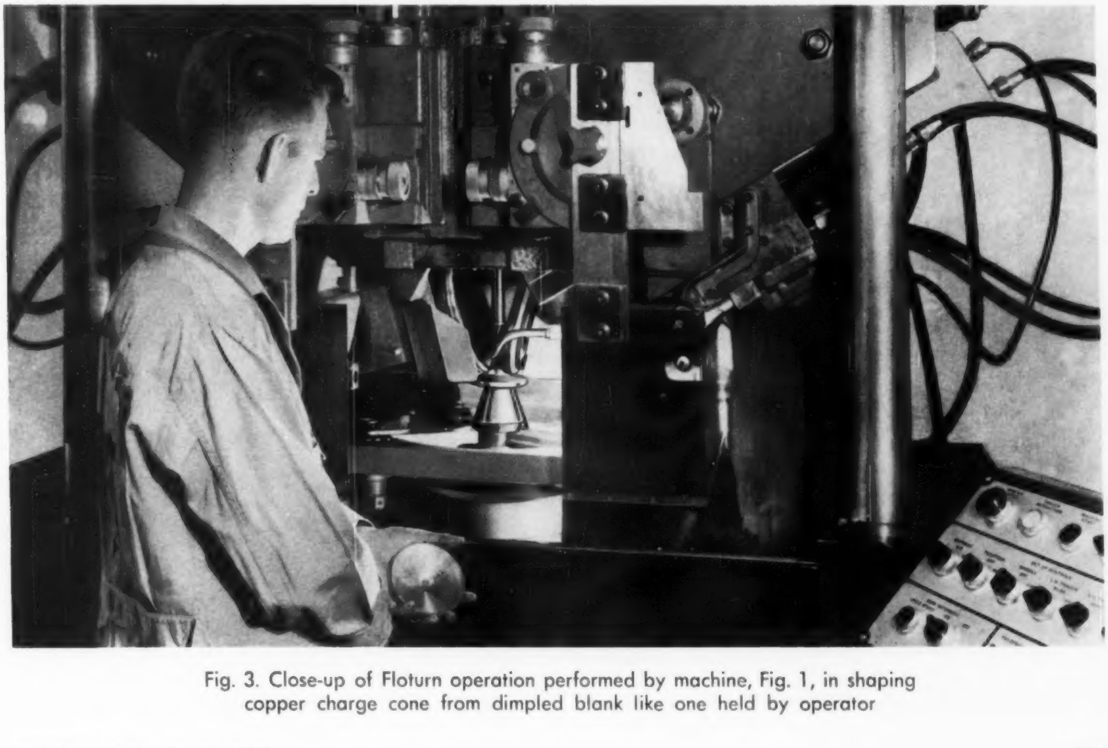


Fig. 3. Close-up of Floturn operation performed by machine, Fig. 1, in shaping copper charge cone from dimpled blank like one held by operator

matic cycle, a combination blank-centering device and finished part-stripper is in position to receive the blank, whether manually or automatically loaded. When the "cycle start" button is pressed, the ram spindle clamps the blank to the mandrel and the carriage moves into the Floturn or "chipless" metal-forming position. The spindle starts and the rollers begin the forming process, under hydraulic tracer control.

At the end or completion of the operation, an automatic trip retracts the carriage and ram and, at the same time, actuates the "stripper" which removes the finished part from the mandrel. All elements of the machine return to the loading position for forming the next or succeeding part.

All electrical control equipment for the machine is furnished in a floor-mounted cabinet which may be remotely located. All hydraulic-system elements are mounted on the fluid reservoir. The 15-hp motor and four pumps are mounted on top of the machine and the solenoid valves in a cabinet on the side. The main drive-motor is rated at 40 hp.

Circle Item 565 on postcard, page 197

## Buffalo Improved Variable-Speed Drilling Machines

A redesigned "R-P-Master" variable-speed drilling machine that offers greater capacities and torque-controlled power feed in addition to many other desirable features is announced by the Buffalo Forge Co., Buffalo, N. Y. The capacities of these machines for drilling in mild steel are 1 inch, 1 1/2 inches, and 2 inches for the Nos. 1A, 2A, and 3A models, respectively.

Exclusive "R-P-Master" power feed consists of an all-geared positive feed with a torque device on the feed-shaft. This device is factory-set for maximum torque. Any overload above the torque setting causes slippage, preventing damage to the machine.

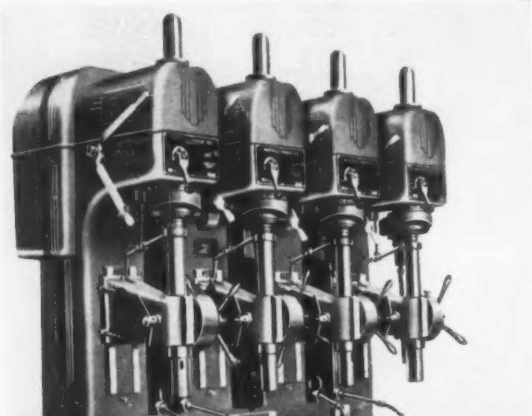
These drilling machines are offered in one- to six-spindle models and are available with standard and special accessories.

Circle Item 566 on postcard, page 197

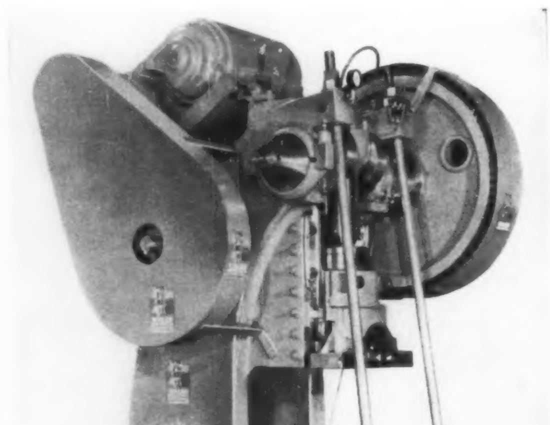
## Walsh Deep-Throat, Open-Back Inclinable Press

A No. 65X deep-throat, open-back inclinable press of 65-ton capacity has been brought out by the Walsh Press & Die Co., Chicago, Ill. This press can be furnished in flywheel and back-gear models with strokes up to and including 7 inches. All regular Walsh features are incorporated in this press, such as die-forged alloy tool steel balanced and precision-ground crankshafts, high tensile-strength frames, large flange slide, and ruggedness where needed in the design of the press frame and other component parts. Variable-speed drives, fully automatic or one-shot grease lubrication, air balancing units, and air cushions can be furnished.

Circle Item 567 on postcard, page 197



Buffalo four-spindle No. 2A R-P-Master drilling machine




Walsh deep-throat, open-back inclinable press

## Sahlin Horizontal Press Unloaders

Horizontal press unloader announced by Sahlin Engineering Co., Inc.

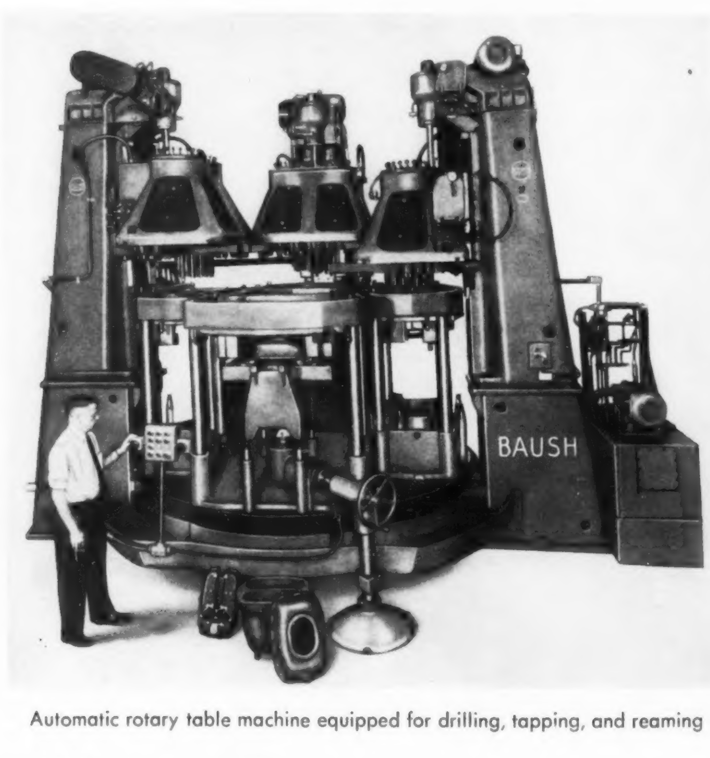
Two small, horizontal press unloaders have been added to its line of press automation equipment by Sahlin Engineering Co., Inc., Birmingham, Mich. One unit, with a 14 1/2-inch stroke, is adaptable to a number of uses. In one automotive plant it is being used to remove scrap from inside the die area of a press, while in another, an unloader with a 16 1/2-inch stroke and a 3-inch lift is employed to unload the second stage of a two-stage die.

Both of these horizontal unloaders can be installed on a number of press types, and because of their compact design are particularly suitable for small and gap presses. Jaw components are interchangeable with standard Sahlin "Iron Hand" jaws. Thus fewer replacement parts need be kept on hand.

Circle Item 568 on postcard, page 197

## Baush Automatic Machine with Mechanical Lead-Screw Feeds for Drilling, Tapping, and Reaming

Mechanical lead-screw feed for drilling, tapping, and reaming is an exclusive feature of automatic rotary table M-20 machines announced by the Baush Machine Tool Co., Springfield, Mass. These units are designed to reduce maintenance costs, insure steadiness of feed, eliminate surge, and lengthen the life of tools. Flexibility and versatility are also outstanding features of this new equipment.




Automatic rotary table machine equipped for drilling, tapping, and reaming

The machine shown in the illustration was developed around three of the M-20 machines. It is equipped with an automatic rotary table 124 inches in diameter and has four indexing stations. This particular machine is set up to handle the necessary drilling, tapping, and reaming of thirty-nine different parts of gas meters. The three vertical multiple-spindle units have 27- by 40-inch rectangular heads. These heads feature completely automatic cycling for high productions, semi-automatic cycling for low production, and a jog cycle for setup.

Each head is bored for thirty-two spindles. The thirty-two upper-spindle drivers are 1 1/2 inches in diameter, arranged for two speeds and a neutral position. Feed is through ball screws with minimum friction from spindle gears. Feed can be varied from 0.005 to 0.090 inch per revolution and spindle speeds can be varied from 130 to 1050 rpm. The feeds and speeds can be disengaged for various cycles by merely positioning selector knobs on the heads.

When a head changes from rapid traverse to feed stroke, an electric brake holds the lead-screw and shuts off the traverse motor, saving considerable wear and tear on the motor, etc. The spindle drive gear rotates a ball nut on the locked lead-screw through gearing to provide a pre-set feed for the tool.

The machine illustrated has a total of ninety-eight spindles and

adjustable arms. Its sequence of operations is as follows: unload and load at the first station; multiple-drill at the second station; multiple-drill, chamfer, and ream at the third station; and multiple tap, using master lead-screw, at the fourth station. The master fixture-holding units and mounting plates are equipped with adapters which have been designed specifically to take care of all thirty-nine different parts.

Circle Item 569 on postcard, page 197

## Duplex "Half-Mill" for Gang-Milling Flats on Shafts

Gang-milling of flats on the opposed ends of short steel shafts can be accomplished efficiently on a high-production "Duplex Half-Mill" developed by the U. S. Burke Machine Tool Division, Cincinnati, Ohio. The machine simultaneously mills ten to twelve shafts. Although the cut is light, large cutters are used, necessitating slow spindle speeds. To achieve this, a flange-mounted, 1800-rpm motor attached to a worm and worm-wheel (10 to 1 reduction) speed reducer is employed in place of a conventional gear-motor. The advantages of this arrangement are exceptionally smooth operation, very compact mounting, and extremely low cost. Spindle speeds of 86, 112, 143, 218, 278, and 360 rpm are provided. In order to avoid having opposed milling cutters machine the ends of the same shaft at the same time, the Half-Mills are mounted with one leading the other by 1 inch.

The machine shown has an 8- by 32-inch table, hardened and ground table ways, and JIC wiring and controls. The table feed cycle includes rapid approach, controlled cutting speed and travel, and automatic rapid return. The U. S. duplex Half-Mill is also available with 6- by 23-, 10- by 36-, 10- by 42-, 10- by 48-, and 10- by 54-inch tables, as well as 12-, 18-, 24-, and 30-inch air-hydraulic or 18- and 30-inch full-hydraulic, longitudinal table feeds. Numerous other combinations of "building-block" features are available for use with the single- or double-column Half-Mills.

Circle Item 570 on postcard, page 197

## Federal Flying Cutoff Press

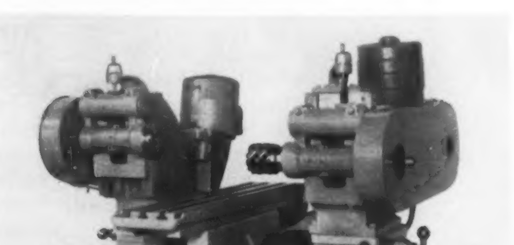
The Federal Press Co., Elkhart, Ind., has introduced a flying cutoff press for use with rolling mills which is said to increase production by as much as 100 per cent. An air-clutch control panel synchronizes the press with the speed of the mill and permits the cutting of any desired lengths of metal channels, bars, angles, moldings, and other stock.

The unit is adaptable to a majority of metalworking operations because its custom-fabricated base permits rotating the press a full 360 degrees, and hydraulic power serves to tilt it to any desired angle for shape forming. It is available with or without the special base and in any desired capacity up to 100 tons.

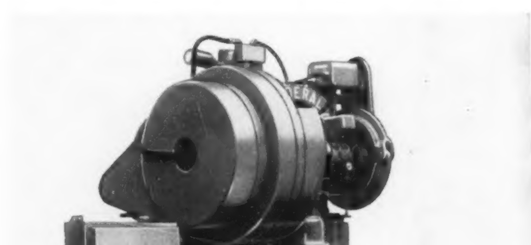
Construction features include a heavy, one-piece, cast-iron frame of high-tensile strength. The machine tool grade cast iron used in the frames has high compressive strength, mass that insures rigidity, high vibration-dampening qualities, and the ability to stand deflection without permanent deformation of the frame.

Additional features are: Timken bearings; oversize crankshafts; solid, web type flywheels; and long V-type ways and gibs.

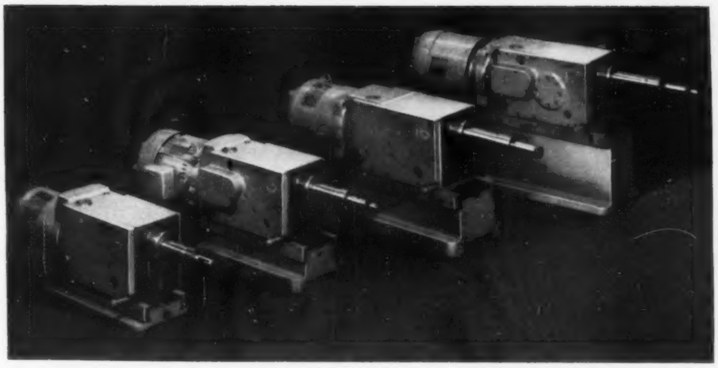
Circle Item 571 on postcard, page 197



Duplex Half-Mill recently brought out by the U. S. Burke Machine Tool Division



Flying cutoff press developed for use with rolling mills by the Federal Press Co.



Long-stroke drilling and tapping units announced by Kingsbury Machine Tool Corporation

## Kingsbury Long-Stroke Drilling and Tapping Units with Cam Feeds

Automatic drilling and tapping units featuring long strokes with cam feeds have been announced by the Kingsbury Machine Tool Corporation, Keene, N. H. The quills of these units when fully extended as shown provide strokes of 4 inches on the Models 4 and 5 units, and 5 inches on the Models 16 and 17 units. Models 4 and 16 are drilling units and Models 5 and 17 are their companion tapping units.

Each unit has a cam feed for accurate repetition of the work cycle. Follower segments make the stroke of the spindle double that of the feed cam. Different speeds, feeds, and strokes are available by changing speed and feed gears and the feed cam. The Model 4 drilling unit with 1/2-hp motor has spindle speeds ranging from 750 to 4100 rpm, and when equipped with 1-hp motor the range is from 1500 to 8200 rpm. The Model 5 tapping unit with a 3/4-hp motor has spindle speeds ranging from 465 to 1415 rpm. The Model 16 drilling unit has a spindle-speed range of 596 to 3500 with a 1 1/2-hp motor. The Model 17 tapping unit with a 1-hp motor has a spindle-speed range of 368 to 2160 rpm.

Each drilling unit may be converted to its companion tapping unit by using a different feed cam, a reversing motor, and controls to reverse them. The tapping units can have time cycles as short as three seconds. The Models 4 and 16 drilling units have capacities of 3/8 and 3/4 inch in cast iron and 3/16 and 1/2 inch in forged steel. Tapping units Models 5 and 17 have capacities of 3/8–16 and 5/8–11 in cast iron, and 5/16–18 and 1/2–20 in forged steel.

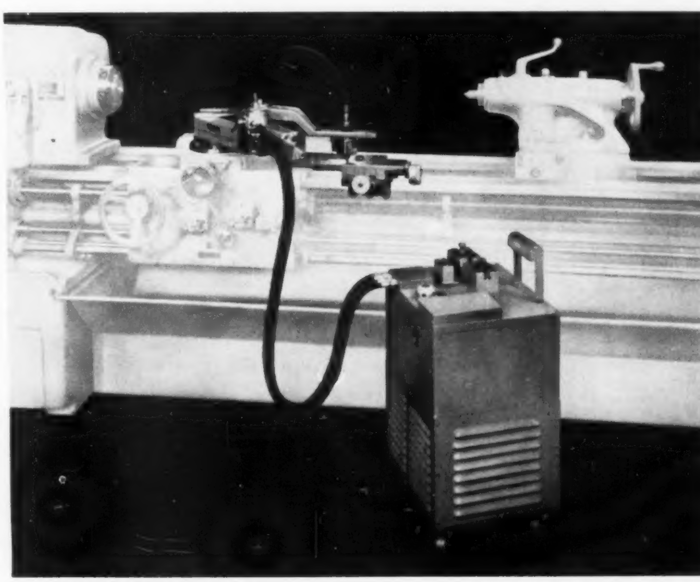
Each unit has a positive drive with friction safety clutch. A rotary pump supplies a continuous flow of oil. Controls may be either air or electric, and are interchangeable. Units may be mounted horizontally, vertically, or at any desired angle. A dovetail base on each unit fits into a mounting adapter of the desired height with a screw for lengthwise adjustment.

Circle Item 572 on postcard, page 197

## "Air-Tracer Pak" for Monarch Lathes

A completely self-contained "Air-Gage Tracer" unit is now available for application to Monarch lathes built by the Monarch Machine Tool Co., Sidney, Ohio. Designated as the "Air-Tracer Pak," this equipment can be used on Series 60, 61, and 62 Monarch machines without any reduction of swing capacity. Removal of the regular compound rest permits quick attachment of the tracer-slide assembly to the cross-slide of lathes in the field. This assembly consists of a hydraulically powered tool-slide and a swivel base having the proper height and bolt-circle size for application to the lathe with which it is to be used. Being of the swiveling type, this adaptation of the Monarch "Air-Gage Tracer" has the versatility needed to handle more complex turning, boring, and facing operations.

The template support is clamped to the front bed "V". Micrometer dials are provided for longitudinal and cross adjustment of the template position. A swivel pin on the support is used in conjunction with a micrometer adjusting bracket for quick and accurate template alignment. Appropriate mounting holes allow the bracket to be positioned properly for both short and long



Monarch lathe equipped with completely self-contained "Air-Gage Tracer" unit

turning templates and for facing templates.

A portable and completely self-contained power unit stands at the front of the machine. The hydraulic pump motor operates on 110-volt, single-phase alternating current. A receptacle on the power unit base provides for easy connection to the electric power source. There is also a connection on the base for the air supply line. On the top of the unit are storage brackets to which the tracer-slide assembly and template support are attached when not in use. Casters on the unit make it portable for storage or for movement to the machine. The hydraulic cylinder stroke is 3 3/4 inches, permitting a 5-inch diameter change with the tracer-slide set at 45 degrees. Maximum template length is 18 inches.

Circle Item 573 on postcard, page 197

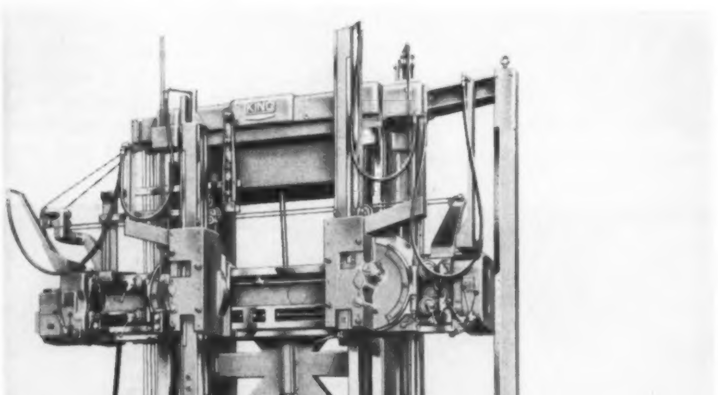
## King Custom-Built Boring Mill for Missile and General-Purpose Machining

The American Steel Foundries, King Machine Tool Division, Cincinnati, Ohio, has just announced the newest of many recently built King "defense production specials." These custom-built King vertical boring and turning machines are designed to meet specialized production requirements, while retaining all standard facilities for general-purpose machining. This equipment was recently installed in one of the nation's major aircraft plants, for use in connection with the missile program.

Special facilities incorporated in this machine are as follows: swiveling type aide-head arranged for tracer-controlled turning and grinding operations; grinding attachment with multiple-speed, precision motorized spindle extending through side-head ram and arranged to receive interchangeable quills and balancing type wheel holders and wheel guard with exhaust outlet; and three-position tool-holder for side-head, which can be readily interchanged with grinder quills for turning operations. An operator-carrier platform is attached to the side-head and there is a console control system.

An electronic, two-dimensional, 360-degree tracer is mounted on the side-head. The template holder is arranged to support templates of the same type required for workpieces utilizing the full capacity of the machine. Universal adjustment is provided for the tracer head. An electronic, two-dimensional, 360-degree tracer is also mounted on the rail-head. A template holder mounted on top of the rail provides for maximum work clearance above table. Positioning controls for the stylus head are supplied for operator convenience. A constant surface-cutting-speed attachment and constant chip-thickness controls are applied to both tracer heads. Coolant is conducted through the rail-head rams.

Circle Item 574 on postcard, page 197




King custom-built boring mill announced by American Steel Foundries, King Machine Tool Division

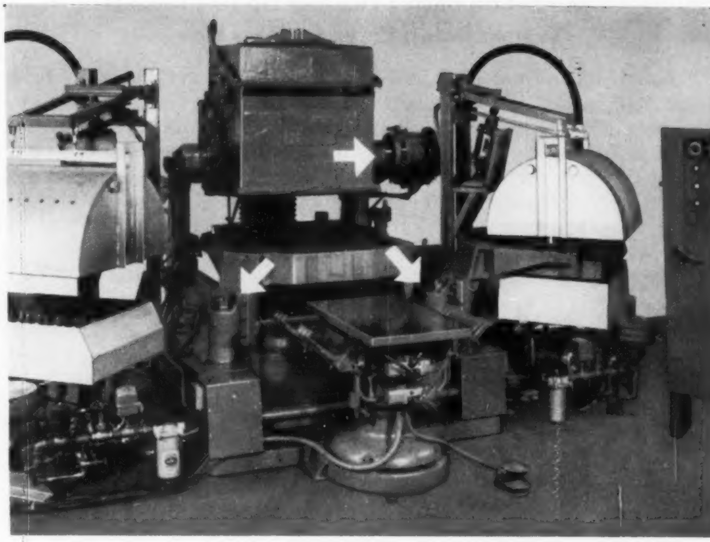
## Clecomatic Screwdriver-Nut Runner

Automatic starting and stopping is a feature incorporated in the "Clecomatic," a screwdriver-nut runner designed by Cleco Air Tools, Houston, Tex. Exceptional speed, economy, and quality control are said to result from its use. The outstanding feature of this tool is an exclusive mechanism which automatically starts the air-motor, then shuts it off automatically and instantly when the screw or nut has been tightened to torque specifications. The operator merely engages the screw with the finder and bit. Following this, the tool does the rest.

The air-motor in this Clecomatic tool operates only during the actual rundown of the nut. This feature saves air and results in less wear on the tool. Operator fatigue is lessened by light weight and smooth, quiet operation. The accurate, non-friction clutch has a "no-drift" adjustment which permits torque to be precisely pre-set and positively maintained. The tool is available in reversing and non-reversing models for running 1/4-inch free-running, No. 10 self-tapping screws.

Circle Item 575 on postcard, page 197

## Twin-Shell Molding Machine Equipped with Rotac Torque Actuators



Chicopee molding machine using three Ex-Cell-O Rotac torque actuators

Three standard Rotac torque actuators, manufactured by the Ex-Cell-O Corporation in its Greenville, Ohio, plant are used in the fully automatic, Chicopee twin-shell molding machine illustrated that produces finished shell molds, alternately on two stations. This machine, produced by Shell Process, Inc., West Springfield, Mass., produces molds for two different jobs at the same time. It can be run with either station inoperative and consumes only a minimum of power.

A standard HN-63-1V Rotac torque actuator is operated at varying pressures up to 800 psi, is used to rotate the investment chamber 180 degrees, and to return it at the end of the cycle. Two standard HN-63-1V Rotac torque actuators are used to swing patterns from investment to ejection stations. The circuit also includes relief valves set to limit the pressure which can build up within the actuator and other circuit members.

Circle Item 576 on postcard, page 197

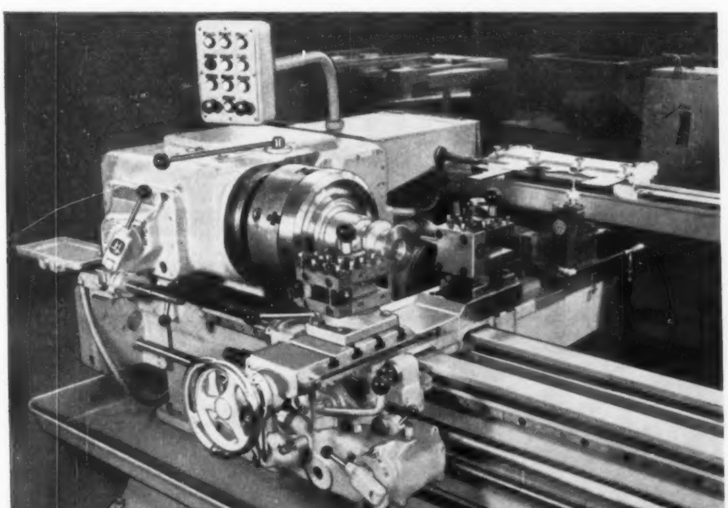
## Two-Dimensional Carriage Tracer for Turret Lathe

A hydraulically controlled tracer which offers four automatically controlled tracing cycles has been announced by the Jones & Lamson Machine Co., Springfield, Vt. This equipment will trace through 180 degrees of tool travel while turning, with the feeding movement either toward, or away from, the headstock. It will also trace through 180 degrees of tool travel while facing, with feed either toward, or away from, the spindle center line. Roughing and finishing tracing tools can be used on the indexing square turret.

Complete size control for diameter is accomplished with the conventional, graduated handwheel, for either tracing or mechanical operations. This unit can also be used as a taper attachment, and with a suitable threading device, will produce tapered threads.

Mounted on the rear of the cross-slide carriage, the tracer does not interfere with the normal operation of the square turret, the hexagon turret, or with tooling positioned at the rear of the cross-slide. Templates and stylus are always in view of the operator and are clear and free from chips and coolant.

Feed limits range from 1/2 inch to 18 inches per minute. When desired, the feed can be changed by a single control even while machining. Turning capacity of the tracer is the same as the mechanical capacity of the machine in 20-inch increments. The facing capacity in either turning or facing cycles ranges up to a change of 6 inches in the radius of the work. This tracer is available on the No. 7 saddle type machines. By removal of the ram saddle it can be used on ram type lathes.



Jones & Lamson two-dimensional carriage tracer for turret lathe

Circle Item 577 on postcard, page 197

## Four Economatics Teamed Up to Process Transmission Cases for Tractors

Although the grouping of individual automatic machines for processing a part cannot be considered as automation in the strictest sense, a team of four Economatics recently designed and built by Buhr Machine Tool Co., Ann Arbor, Mich., has been arranged to give many of the advantages provided by automation. Because the individual machines are simpler than an entire line would be, it has been easy to introduce new ideas in their equipment and use. This team of machines, Fig. 1, finishes all the openings in both sides and both ends of cast-iron tractor transmission cases shown in Fig. 2. Operations are completed on one piece in each machine, including unloading and loading, in from 1.6 to 2.8 minutes. Work on the piece requiring the 2.8-minute cycle time includes a back-boring operation.

Each of the four machines is served by an operator. Hoists are used to unload and load the heavy work-pieces. The time allowed for these operations varies. The finished work-piece off the first machine is not necessarily the next work-piece handled in the second machine. Partially finished parts are banked between each pair of machines.

Just as transfer machines have been used advantageously in teams with partially finished work-pieces stockpiled between them, it has been possible to obtain several advantages by using the four separate machines shown in Fig. 1 to perform operations necessary in processing the work-pieces illustrated in Fig. 2. If one machine is down for tool changing or maintenance, the other three can continue producing. Separate machines can also be arranged in any manner or order. This results in the best possible work-flow pattern for a particular location. It also permits relocation of the machines should they be converted to other operations or other work-piece designs at some future time.

Along with this maintenance and positioning flexibility, these machines have the advantage of automatic operation. After a part is loaded into any of the machines, the operator pushes two buttons and all machining operations are performed automatically. The basic design of each machine is the same. There is a welded-steel center base with a built-in, chip clean-out trough. This center base has an island to hold a fixture. Horizontal wing bases are dowelled and bolted to the center base, and each wing base carries a standard Buhr hydraulic feed unit.

The first machine rough- and semifinish-bores openings in the right- and left-hand sides, and the bell end of the transmission case. This is a three-way machine. Another three-way machine, the second in line, finish-bores the openings roughed and semifinished on the first machine. The third machine, also of the three-way type, finish-bores opening on the left-hand side, and both the bell and buckle-up ends of the tractor transmission case. Precision boring heads are individually mounted and timing-belt driven on the second and third machines. The fourth machine is a two-way type with cross-facing heads on both hydraulic feed units. Facing tools are hydraulically fed out to face the buckle-up end and the inner wall of the bell end.

A stationary fixture on each machine holds one work-piece. The part is loaded between guide rails with its top face down and resting on hardened and ground pads. It is located by two, automatically operated disappearing locating pins, and is held in position by means of a hydraulically operated swinging strap clamp. Manually operated jacks take up side thrust.

**Circle Item 578 on postcard, page 197**

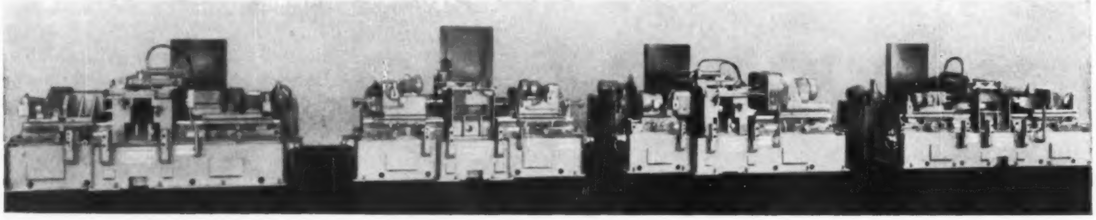


Fig. 1. Four Buhr Economatics teamed up for processing transmission cases shown in Fig. 2

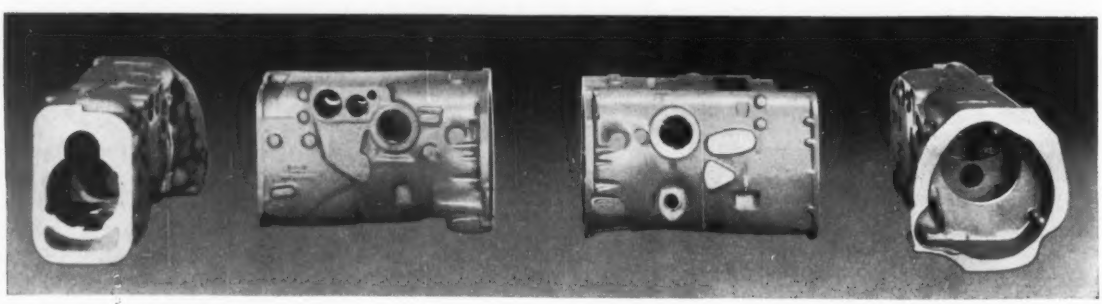
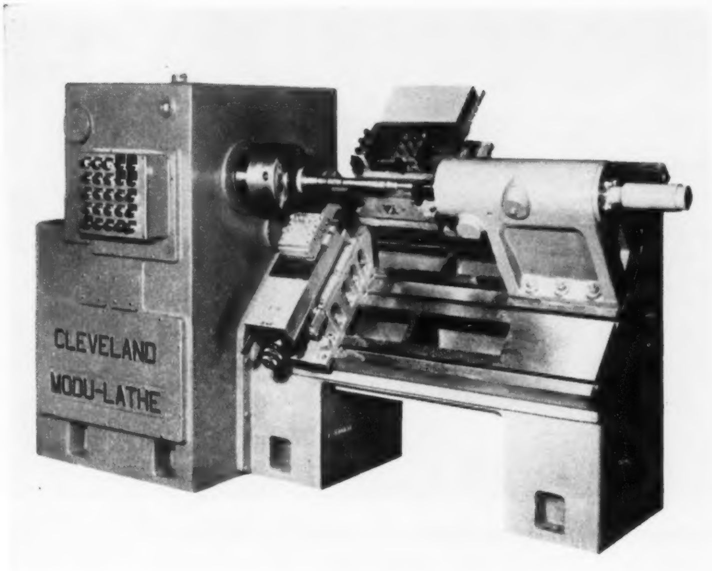


Fig. 2. Cast-iron transmission cases for tractors processed by four Buhr Economatics grouped as shown in Fig. 1



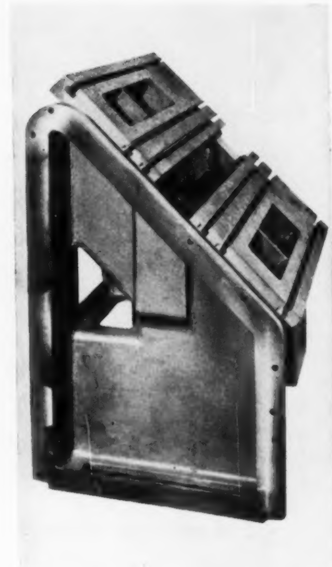


Fig. 1. (Left) Modu-Lathe of line of machines using "building-block" construction brought out by Cleveland Hobbing & Machine Co. Fig. 2. (Right) End view of Modu-Lathe bed showing webbing, chip chutes, and massive construction

## Line of Lathes, Automatics, and Chucking Machines Using "Building-Block" Construction

A line of obsolescence-proof lathes, automatics, and chucking machines is announced by the Cleveland Hobbing & Machine Co., a division of Textron, Inc., Cleveland, Ohio. These units, using modular construction, are said to combine super-rigidity with many interchangeable production-proven components that universally unite with any one of six precision, heavy-duty headstocks and four rigid beds to create machines to exactly meet customer requirements. The modular construction permits the purchaser to buy only what he needs when he needs it and permits him to add components or change them at any time. Thus, the capitalization cost of the base machine is extremely low because components in many models are considered as tooling with tangible advantages in depreciation or write-off.

The components are run in production lots to provide high quality at low cost. The headstock and bed are of exceptionally heavy construction and are designed to form a structure of maximum rigidity when assembled. With the use of the super-rigid base machine and a wide selection of heavy-duty components, most any production type turning machine can be created. All components are readily available and fit universally, permitting machines to be changed over or rebuilt with factory-new components quickly and economically.

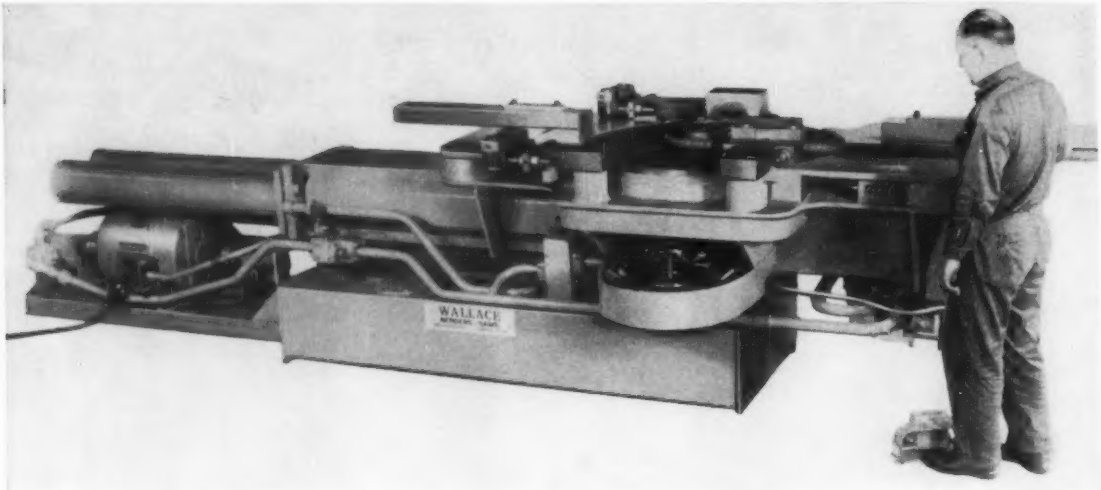
The Modu-Lathe seen in Fig. 1, for example, can be furnished with any one of four different lengths of beds, one of which is shown in Fig. 2. The lathe, as shown in Fig. 1, has a 58-inch bed with 7- and 14-inch cross-slides and tailstock.

Cleveland's six precision headstocks feature high-speed turning (speeds up to 5000 rpm are available) and extremely heavy housing construction using high-tensile cast iron for the major walls, which are 2 inches thick. Four super-rigid beds of varying length universally unite with headstocks and other components to make various types of "Modular Machines." They are available in a range of sizes from a 30-inch pedestal type bed weighing 1500 pounds to a 140-inch bed weighing 6000 pounds. Abundant ribbing and exceptionally heavy wall sections assure the necessary rigidity for the most demanding production requirements.

Other universally interchangeable components include: cross-slides, profiling slides; back-off profiling slides; flat and round template positioners; rocking cross-slides; indexing toolposts; six-station turrets; indexing type boring toolposts; automatic turret controls; hydraulic controls; spindle-indexing mechanisms; tracing controls; single compound cross-slides; hydraulic tailstocks; multiple-pass re-cycle controls; thread-cutting screws; high-speed collet assemblies; two- and three-roller hydraulic follower rests; bar feeders; thread-rolling, knurling, and lettering attachments; two- and three-roller hydraulic steadyrests; standard motorized components; etc. All ways on all components are hardened, ground, and replaceable.

Cleveland's line of Modular turning machines, named Modu-Trace, Modu-Chuck, Modu-Lathe, and Modu-Matic have been designed and built to insure outstanding rigidity, precision, and dependability, and to incorporate the latest developments in high-production machine tools.

Circle Item 579 on postcard, page 197



Bending machine for concrete reinforcement bars announced by Wallace Supplies Mfg. Co.

### Wallace Reinforcement-Bar Bender

Wallace Supplies Mfg. Co., Chicago, Ill., has announced a No. 92 bender designed to bend concrete reinforcement bars up to 2 3/8 inches in diameter at the rate of approximately 7 rpm. The power of the twin-cylinder drive of this bender is transferred to the shaft by super-strength roller chain. Its twin cylinders have been arranged to guarantee equal force for bending in either direction. It is not necessary to turn the bar end-for-end in making double offset bends. A speed-control valve is provided to permit bending of high-carbon steel bars.

This machine has a foot-operated electric control with two pedals—one for right—and one for left-hand bending. A degree-of-bend selector has four adjustable stops in each direction of rotation. The stops can be pre-set for the desired angles of bend. A 30-hp motor may be wired for either 220- or 440-volt, 3-phase, 60-cycle alternating current. The electric control circuit is 100 volts. A floor space (no allowance for swing bar) 48 inches by 17 feet 5 inches is required. The machine weighs approximately 10,000 pounds.

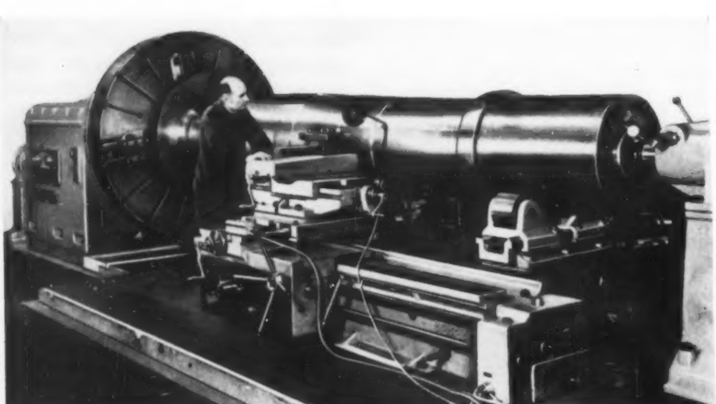
Circle Item 580 on postcard, page 197

### Faceplate Lathe for Machining Large, Lightweight Pieces

Ravensburg faceplate lathes, with baseplate designed to provide an efficient, economical means of machining extremely large yet comparatively light work-pieces, are now available in the United States from the Cosa Corporation, New York City. The most economical application of these machines is said to be in the turning and facing of large-diameter work-pieces such as missile bodies and steam-turbine runner discs. They are also adapted for use in the machining of generating plant, mining, and shipbuilding equipment.

These lathes feature separate headstock, baseplate, and bed units which can be built to meet specific requirements. The headstock is supplied with a 12- or 18-step gear-box containing hardened and ground gears. Alternatively, headstocks are also available with mechanically or electrically controlled stepless speed variators.

Saddle and cross-slide feeding is available in either inches per minute or inches per revolution of work. Feed gear drive is from the main gear-box by means of a patented electrical shaft system that eliminates any mechanical connection between bed and headstock. Thus, only an electric cable is connected to the separate feed motor on the saddle, so that an accurate feeding motion is reproduced as a function of spindle speed.



Ravensburg faceplate lathe available in this country from the Cosa Corporation

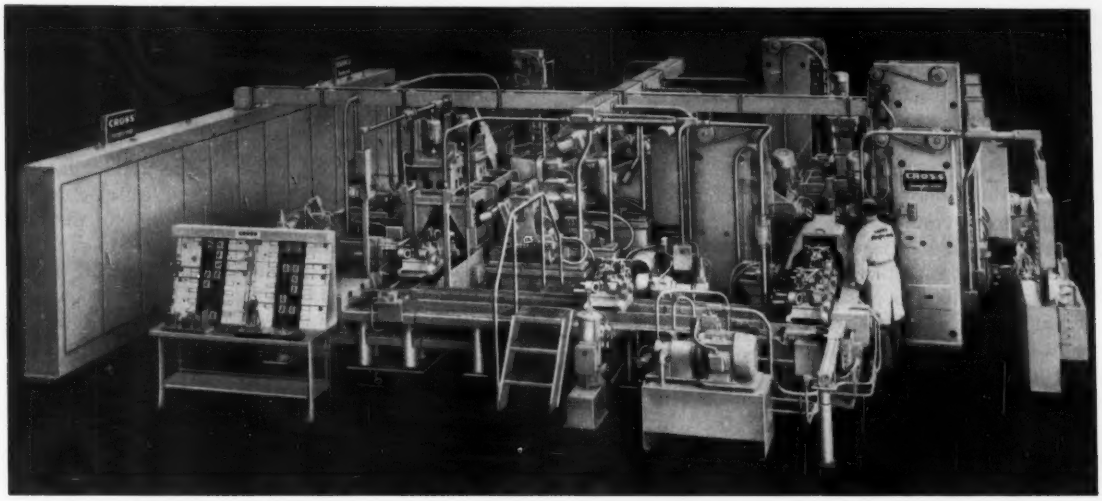


Fig. 1. Cross Transfer-matic equipped to process aluminum power frames for typewriter

The upper slide on the cross-slide is mounted on a turntable and feeds automatically at any angle within 360 degrees. The top tool-holder slide is hand-adjustable. The cross-slide can also be provided with an optional hydraulic or electronic-hydraulic copying attachment for accurate reproduction of forms or contours from a template.

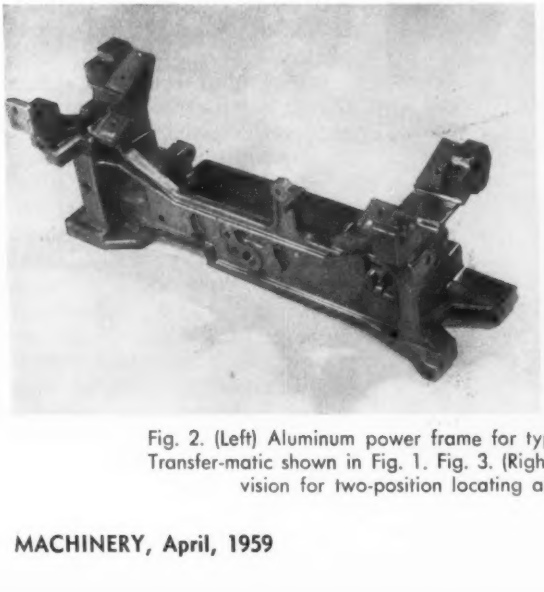
The turning diameter over the baseplate is 80 to 110 inches. Turning diameter capacity over the pit depends on the pit depth. The weight of unsupported workpieces with the center of gravity 12 inches from faceplate, which can be handled on these machines, ranges from 6500 to 20,000 pounds.

Circle Item 581 on postcard, page 197

## Cross Transfer-matic Equipped for Complete Processing of Typewriter Power Frames

The Cross Company, Detroit, Mich., has designed and built a pallet type Transfer-matic, Fig. 1, which completely processes the delicate aluminum die-cast typewriter power frame seen in Fig. 2. The power frame, believed to be one of the most delicate parts ever handled in a transfer machine, is being produced at the rate of 150 pieces per hour. Altogether 105 broaching, milling, drilling, reaming, spot-facing, chamfering, and tapping operations are performed on each part.

A number of dimensions on the part are held to close tolerances. The carriage-support rail seats, for example, must be maintained in a plane that is true within 0.001 inch. The over-all length must be held to size within 0.003 inch. The shaft holes are required to be in line from end to end within 0.001 inch. Hole locations relative to milled surfaces are held within 0.003 inch and the four broached spring seats must be in a plane that is accurate within 0.005 inch. To maintain these tolerances, parts like the one illustrated in Fig. 2 are processed in two-position pallets incorporating special power clamping fixtures of the design shown in Fig. 3. Each part is carried twice from the loading station



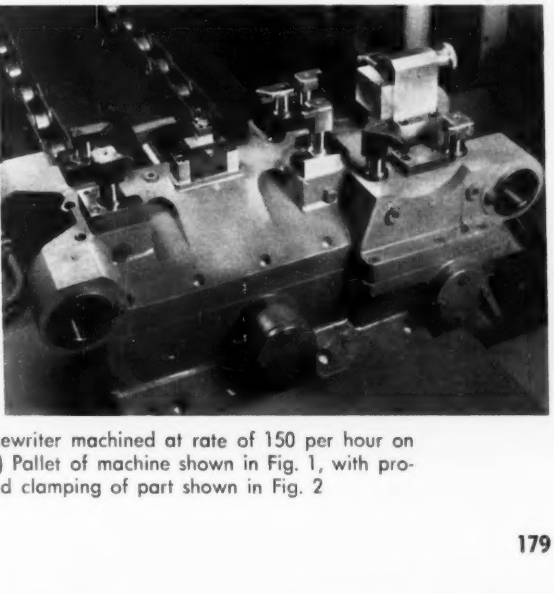


Fig. 2. (Left) Aluminum power frame for typewriter machined at rate of 150 per hour on Transfer-matic shown in Fig. 1. Fig. 3. (Right) Pallet of machine shown in Fig. 1, with provision for two-position locating and clamping of part shown in Fig. 2

through ten machining stations in two different positions. Initially, the part is processed in the "A" position with the top, bottom, and back side exposed to machine units. In the second trip, the part is clamped in the "B" position with the ends exposed to machine units.

In the first section of the Transfer-matic, which has five machining stations, six rough- and finish-milling and a total of forty-seven horizontal and vertical drilling, reaming, spot-facing, and tapping operations are performed on parts in both positions. Pallets are then transferred to Section II by a standard chain-type conveyor. In Section II, four angular broaching and a total of forty-nine drilling, reaming, and tapping operations complete the machining. Following these operations, pallets are transferred through a blow-off booth where the parts are air-cleaned. Pallets are then returned to the load-unload station at the head of Section I by conveyor.

Two precision in-line drilling and reaming operations performed at Stations No. 4 and No. 11 require special "snorkel type" travelling guide bushings to prevent the tool from wandering between holes. In both cases, the holes machined are widely separated and must be held in line within 0.001 inch. In both stations, special hydraulically actuated mechanisms mounted over machine units descend and position drill bushings when the pallet is located in the work station.

All four spring seats which are held in a plane that is accurate within 0.005 inch are broached simultaneously in a single pass by a broaching unit at Station No. 11. To minimize distortion and deflection of the part during machining, high cutting speeds are employed, with fine feeds to reduce cutting pressures.

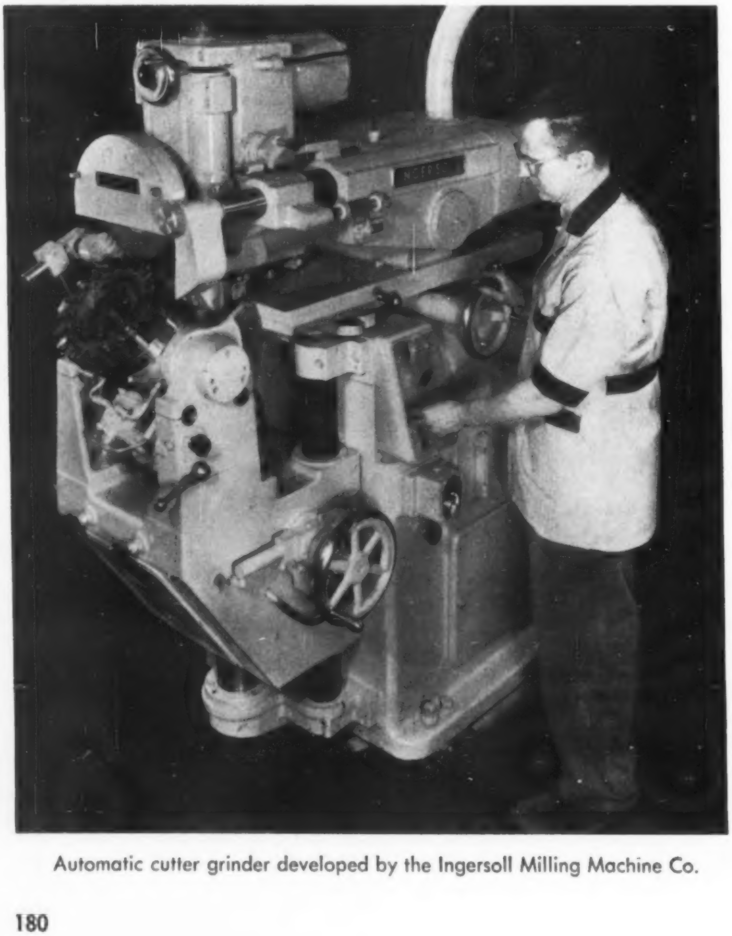
The Cross machine-control unit, Toolometers, and programmed tool changes serve to minimize down time. Where applicable, all tooling is of the quick-change, pre-set type. To prolong periods between tool changes, machining operations are flooded with coolant from a central coolant system.

For operation at a peak capacity of 156 frames per hour over extended periods of time, an auxiliary load-unload station is provided at Station No. 14 at the end of Section II. If a second operator is employed, he can assist in unclamping and removing or repositioning parts in the pallets.

Circle Item 582 on postcard, page 197

## Ingersoll Automatic Cutter Grinder

Labor savings in the grinding room and increased production in the machine shop are twin objectives of an automatic cutter grinder which has been developed by the Ingersoll Milling Machine Co., Rockford, Ill. A man can operate more than one of these automatic grinders, thus reducing toolroom costs substantially. It is claimed that better grinds resulting from mechanical control of the grinding action obtained with this machine will lengthen cutter life and improve accuracy and finishes. Thus, more work can be obtained from large tools.



Automatic cutter grinder developed by the Ingersoll Milling Machine Co.

This grinder will do a complete sharpening job on a wide range of milling cutters since it will grind on the outside diameter as well as the face and bevel of any cutter within its 4- to 20-inch capacity. It spin-grinds newly filled cutters to size.

A new dust collection system is built into the machine and moving parts are given positive protection against dirt. As the grinding wheel wears, the spindle speed automatically increases so that constant surface speed is maintained. The wheel is automatically dressed with every stroke.

The machine was developed specifically for grinding a variety of inserted-blade carbide cutters used in general-purpose, job-shop milling. Setups are easily and rapidly changed from one size and type of cutter to another.

Circle Item 583 on postcard, page 197

## Vertical Honing Machines with Automatic Control

Two series of vertical honing machines, incorporating many improvements, have been added to the line of equipment made by the C. Allen Fulmer Co., Cincinnati, Ohio. The units are of the twin-cylinder, cross-head type, which made it possible to decrease the over-all height of the machines. The Model 12 series is available with up to 60-inch strokes and up to 25-hp motors, while the Model 18 series offers up to 120-inch strokes and up to 35-hp motors.

Both series include as standard equipment the Fulmer "Fulfeed" system for controlling the honing tools. This system retains the many advantages of the mechanical brake type honing tools, and in addition, provides completely automatic and manual remote control of tool expansion and retraction. Featured are automatic fast feed out, timed "spark-out" cycle, and retraction of the tool.

The Fulmer system can be set up for automatic operation under control of a cycle timer, or of an automatic sizer. The automatic sizing device is of a new, less complicated design, providing accurate sizing with an inexpensive unit.

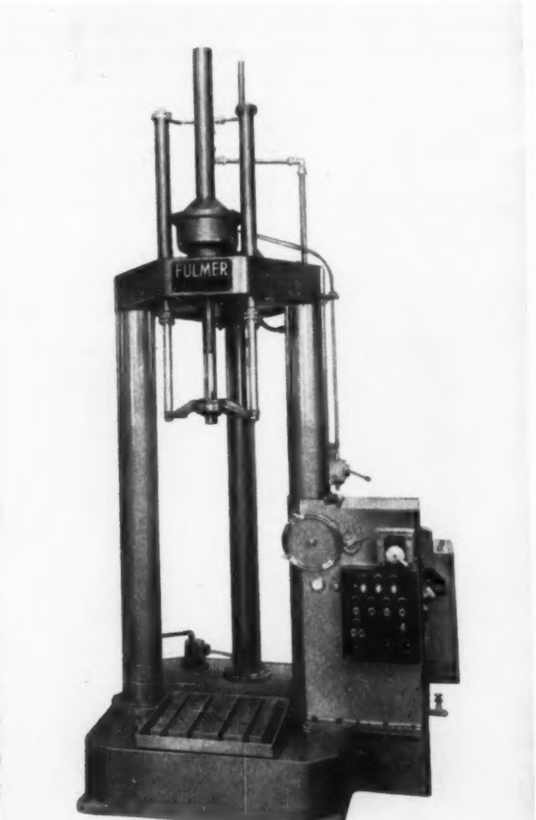
The equipment features completely enclosed JIC hydraulic systems with larger than normal hydraulic reservoirs. The coolant system is enclosed within the base, and can store two different types of honing coolant. Either one is available for use without the necessity of draining the coolant reservoir.

Circle Item 584 on postcard, page 197

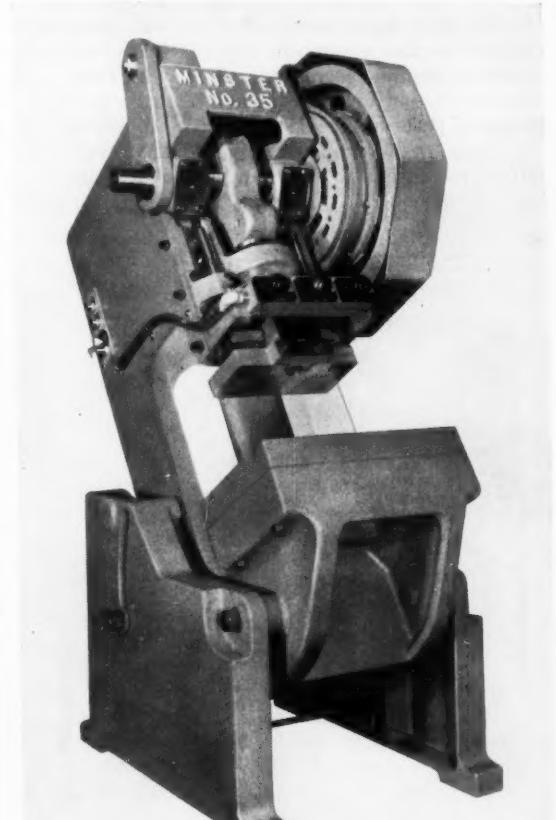
## Minster Open-Back Inclinable Presses

A line of improved open-back, inclinable presses, designated Series I, is now being manufactured by the Minster Machine Co., Minster, Ohio. Variations in the specifications of these 35-, 45-, and 60-ton capacity presses have been limited so that this series can be supplied to meet urgent customer needs. Exclusive features include a Minster re-circulating lubrication system which can be furnished as an optional extra. The system continuously lubricates main and connection bearings, gibs, gears, and counterbalances. Enclosed within the press frame and protected from damage, the lubrication system is said to lower maintenance and cleanup costs and to prolong life.

Other improved features furnished as standard are a modified




Vertical honing machine of improved series announced by C. Allen Fulmer Co.




Open-back, inclinable press of improved line announced by the Minster Machine Co.

flanged slide which gives a larger die area and an exclusive, lower connection ball-box adjustment consisting of a threaded take-up nut. This nut can be adjusted with a spanner wrench to quickly take up a ball-box clearance without the time-consuming task of dismantling the slide. A neoprene shield prevents foreign material from entering the ball-box bearing and eliminates oil splash.

These units are equipped with the Minster patented combination air friction-clutch and brake unit which provides torque overload control, greater tripping efficiency, and controlled cycling and inching. A centralized control package is mounted in a cored recess area at the top of the press frame.

The one-piece, high-tensile alloy press frame of cast construction has a boxed top to assure rigidity and high compressive strength. The manually operated inclining mechanism consists of a screw arrangement located at normal working height on the side of the press.

Circle Item 585 on postcard, page 197

## Machine Separates Barrel-Finished Parts and Abrasive

A design principle said to provide for more effective screening and separation of barrel-finished parts and abrasive media has been built into a vibrating type separator machine recently introduced by Roto-Finish Co., Kalamazoo, Mich. The unique feature of this separator is a vibrating unit which imparts high-frequency, low-amplitude vibrations to the screening mechanism. This equipment is designed to permit faster, more efficient separation and screening of processed parts and media sizes.

A large bed, with a screening surface measuring 18 inches wide and 48 inches long, presents a greater work area than that of earlier type machines and does a more effective separation job with a wider range of parts and media sizes and shapes. Another important feature is the separator's adaptability for handling all standard screen mesh sizes. Powered by a 220/440 volt, 3-phase, 60-cycle alternating-current motor with standard non-reversing push-button controls, it comes equipped with three screens for most standard separating operations. The vibrating unit is completely shock-mounted to dampen vibrations in the separator.

Circle Item 586 on postcard, page 197

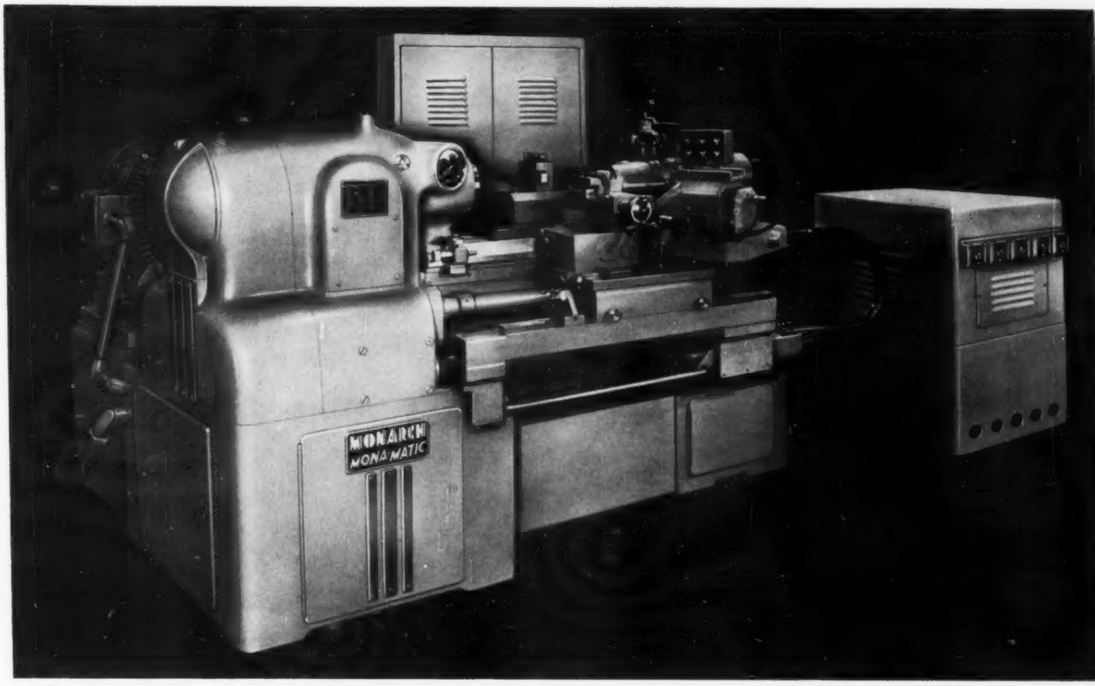
## "TM" Idealarc Welders

The Lincoln Electric Co., Cleveland, Ohio, has announced a line of industrial arc-welding machines designed for manual operation. These welders, called the "TM" Idealarc, are said to have improved arc characteristics and many new optional features. It is claimed that they can be supplied "tailor-made" to suit customer needs at a price consistent with large-volume production. The welders are available either as alternating-current transformer welders or combination alternating- and direct-current rectifier welders. They have a mechanical, movable-core, reactor type of current control and are made in NEMA-rated 300-, 400-, 500-, and 650-ampere sizes.

Optional features include remote control of current and polarity; a low-voltage contactor that reduces open-circuit voltage when the current is on but the machine is not welding; a line contactor (starter) with overload protection and either a line- or 115-volt push-button; and an arc booster that provides a current surge during arc striking, or power-factor correction condensers. All optional equipment can be mounted inside the welder. The machines have a safe 73-volt, open-

Roto-Finish vibrating separator


Lincoln "TM" Idealarc welder



Monarch Model 20-H Mona-Matic high-speed, automatic cycle lathe with "Air-Gage Tracer" and hydraulically powered front carriage and rear slide

circuit voltage, yet produce a very stable arc even with low alternating-current amperage.

Circle Item 587 on postcard, page 197

## "Hocut" Synthetic Coolant

E. F. Houghton & Co., Philadelphia, Pa., has brought out a chemical type cutting coolant known as "Hocut 237," for use wherever it is feasible to employ water dilution of a non-petroleum cutting fluid to carry away heat, provide good tool life, and prevent rust. This coolant is said to be free from rancidity and to provide a stable emulsion.

Forgings for missile guidance systems are being machined at greatly increased production rates and with longer tool life through the use of this coolant. The steel being machined is aircraft 4140 in the form of forgings about 6 inches in diameter and 8 inches long. Operators had been making rough and finish cuts in the 4140 material to produce about 28 finished pieces per day. The new coolant eliminated the rough cut, thereby raising output from twenty-eight to eighty pieces per day.

Circle Item 588 on postcard, page 197

## Monarch Automatic Double-Carriage Lathe with "Air-Gage Tracer"

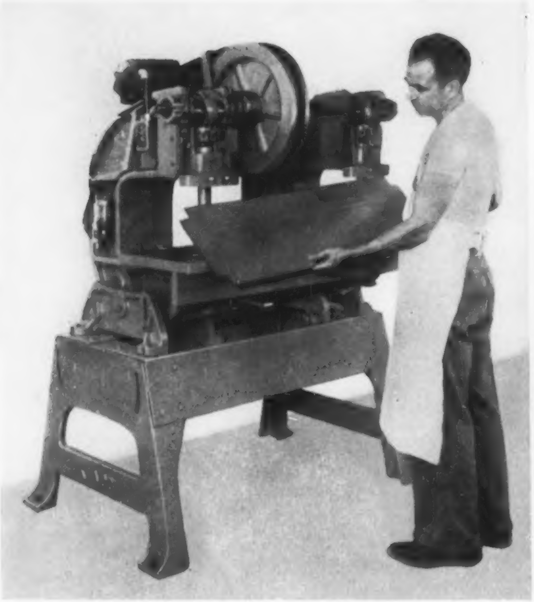
A Model 20-H Mona-Matic automatic double-carriage turning lathe, with the front tool-slide controlled by a 60-degree "Air-Gage Tracer," has been brought out by the Monarch Machine Tool Co., Sidney, Ohio. The variety of automatic cycling arrangements available on this machine provide high productiveness and versatility. The hydraulically powered front carriage and rear slide are designed to assure dependable performance.

The machine is available in center-distance capacities of 18, 30, and 42 inches. Swing over the bed is 15 inches and over the front slide and rear slide ways, 8 inches. Bed ways are flame-hardened and ground. A two-speed, main-drive motor may be applied to the helical-geared headstock equipped with power clutch and brake. Eight spindle speeds in each of three standard ranges are obtained by means of pick-off gears. The tailstock has an air-actuated spindle and built-in, heavy-duty, antifriction center.

Front carriage feed and traverse are accomplished by a cylinder mounted in the apron. Feed rates are infinitely variable from 1 inch to 40 inches per minute. Carriage traverse is 200 inches per minute. Rear-slide feed rate is 1/2 inch to 40 inches per minute while traverse is at 90 inches per minute. The rear slide has an adjustable positive stop to control maximum slide travel. The hydraulic power unit stands on the floor at the tailstock end of the machine. All cycle valving is manifold-mounted. Compensated feed-rate controllers at the front of the unit permit presetting of each feed for front carriage and rear slide.

Provision can be made for either a one- or a two-cut cycle. Four different feeds are available to the carriage for use with a single cycle. On two-cut cycle lathes one feed only may be employed during the rough cut while the remaining three feeds are available for the finish cut. Two-cut cycle machines are provided with a selector switch for one- or two-cut operations.

Circle Item 589 on postcard, page 197



Kenco Mark II-C punch press with two deep-throat punching units

Roto-Torque attachment brought out by the M & M Tool Mfg. Co.

## Double-Ram, Deep-Throat Punch Press

The Kenco Mfg. Co., Los Angeles, Calif., has just introduced its Mark II-C double-ram, deep-throat punch press. This unit consists of two 5-ton, deep-throat punch presses arranged to permit punching to the center of material 25 inches wide and up to 60 inches in length. It employs the new Kenco "Cyclo-Safe" roller clutch, which made it possible to locate the drive centrally between the two vertical press units.

This arrangement eliminates torsional twist stresses on the crankshaft and allows synchronization of the rams and even distribution of power throughout the entire area of the machine.

The Cyclo-Safe roller clutch can be operated manually or electrically and can be furnished with positive two-hand control. This assures the safety of the operator and precise timing of the clutch which facilitates synchronization with auxiliary equipment. The Mark series presses are available in many models which can be engineered to meet the customer's specifications for handling a wide range of punch press work.

Circle Item 590 on postcard, page 197

## Roto-Torque Power Attachment

A Roto-Torque power attachment designed for easy installation on Troyke and other hand-feed milling tables has been brought out by the M & M Tool Mfg. Co., Dayton, Ohio. With this attachment, rotary tables can be changed from hand feed to power feed in less than one minute. The Roto-Torque attachment has variable-speed control so that the table can be run at proper milling speeds. A switch provides for forward and reverse operation. The attachment is especially adapted for use where a smooth finish on all special form work such as radii, contours, cams, or cavities is required.

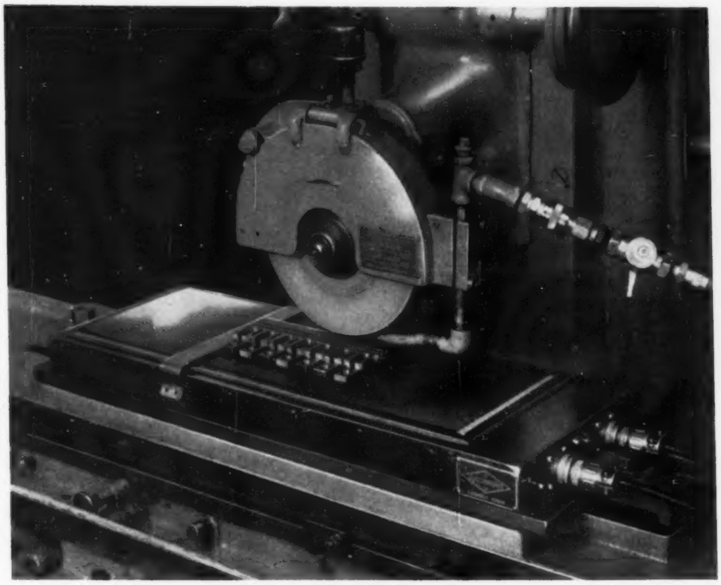
Circle Item 591 on postcard, page 197

## Electrostatic Chuck for Holding Any Metal or Non-Metallic Work-Pieces

Electrostatic chucking equipment recently announced by Electroforce, Inc., Fairfield, Conn., resembles standard, magnetic chucks in appearance and in the way in which they hold work-pieces, but operates on entirely new principles (covered by basic patents). These chucks are said to be the first to achieve practical application of electrostatic rather than electromagnetic force for chucking small parts.

Any electrical conductor such as aluminum, copper, bronze, brass, stainless steels, magnesium, etc., as well as the ferrous metals, can be held on this type of chuck with equal efficiency. Also, it is possible to chuck ceramics or plastics if these are first "flashed" on the holding surface with a metallic coating as little as five millionths of an inch in thickness.

Basic equipment units in the system consist of the chuck itself, designed for use on standard surface grinders or adaptable to many special requirements; a compact power supply which may be located adjacent to the machine; the "Dri-box," in which the work is kept moisture-free at slightly above room temperature; and the coolant pump and filter unit required to furnish a supply of clean, dielectric, non-aqueous coolant. Except for the use of this coolant, and care in maintaining moisture-free and metal-particle-free cleanliness



Electrostatic chuck announced by Electroforce, Inc.

on the holding surfaces, no special procedures are required. Work is instantly gripped and released by a simple control switch.

There is, of course, no "residual magnetism" with this system, even when used with ferrous materials. The equipment operates on standard 110-volt, 60-cycle, alternating single-phase current from a three-wire grounded circuit. Total power consumption is approximately 250 watts.

Circle Item 592 on postcard, page 197

## DoALL Heavy-Duty Band Cutoff Machine

The DoALL Co., Des Plaines, Ill., has introduced a Model C-24 heavy-duty power saw, which is available with a selection of versatile work-handling devices. The basic equipment illustrated compactly integrates a 24- by 24-inch capacity cutting head, main vise, hydraulic system, coolant system, and movable control console. The cutting head is inverted and the top portion of the saw band is twisted inward. This permits the work to be held between the carrier wheels and allows the entire assembly to be lowered. A 15-hp drive furnishes ample power for the tremendous cutting potential of the 2-inch wide "Demon" high-speed steel saw band recently developed by DoALL. A hydraulic motor drive assures efficient delivery of this power to the drive wheel and provides a variable speed range of 20 to 200 feet per minute, saw-band velocity.

The controls for the drive are in a movable console. This enables the operator to view the work from his control station. A tachometer and infinitely variable speed and feed controls enable him to carefully monitor the operation for maximum cutting rates and saw-band life.

Among the new features is a built-in chip-conveyor system that automatically clears away the chips, thoroughly drains them, and then discharges them into a suitable container. Unlike fixed saw guides that must be carefully adjusted for proper clearance, the Model C-24 uses hydraulic guides that automatically apply uniform side loading to the saw band. Flood coolant is provided by a 25-gallon capacity re-circulating system. Vise jaws and bed are faced with hardened, replaceable wear pads.

The feature that adapts the Model C-24 to many diverse applications is the wide combination of work-handling equipment which is available. Each basic machine includes a roller table on the "load" side of the saw band with or without powered rollers. Up to 60 feet of powered conveyor tables can be added to both the "load" and "unload" side of the basic machine, and additional runout tables can be added to the motorized units as far as required. The powered conveyor tables are reversible and controlled from the main control console. Either standard 3400-pound or heavy-duty 10,000-pound capacity rollers may be specified, and they may be hardened and ground for severe applications.

Another useful work-handling feature is the hydraulic lift rollers. These are located in place of the standard rollers nearest the vise bed on either "load" or "unload" side. From the control console the operator can raise these rollers 1 inch. This clears the vise bed when moving work into position.

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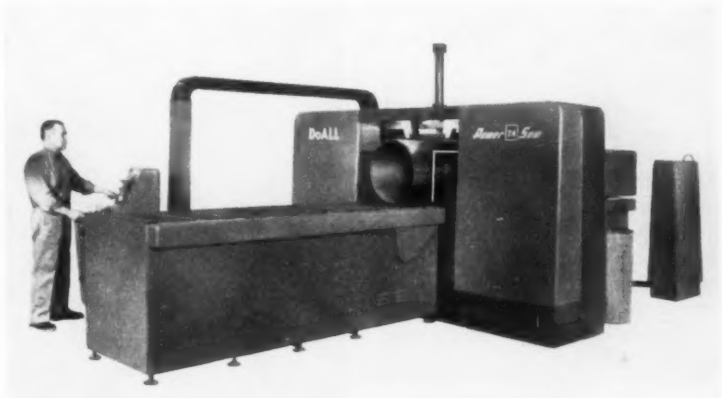



DoALL Model C-24 power saw for heavy cutoff jobs

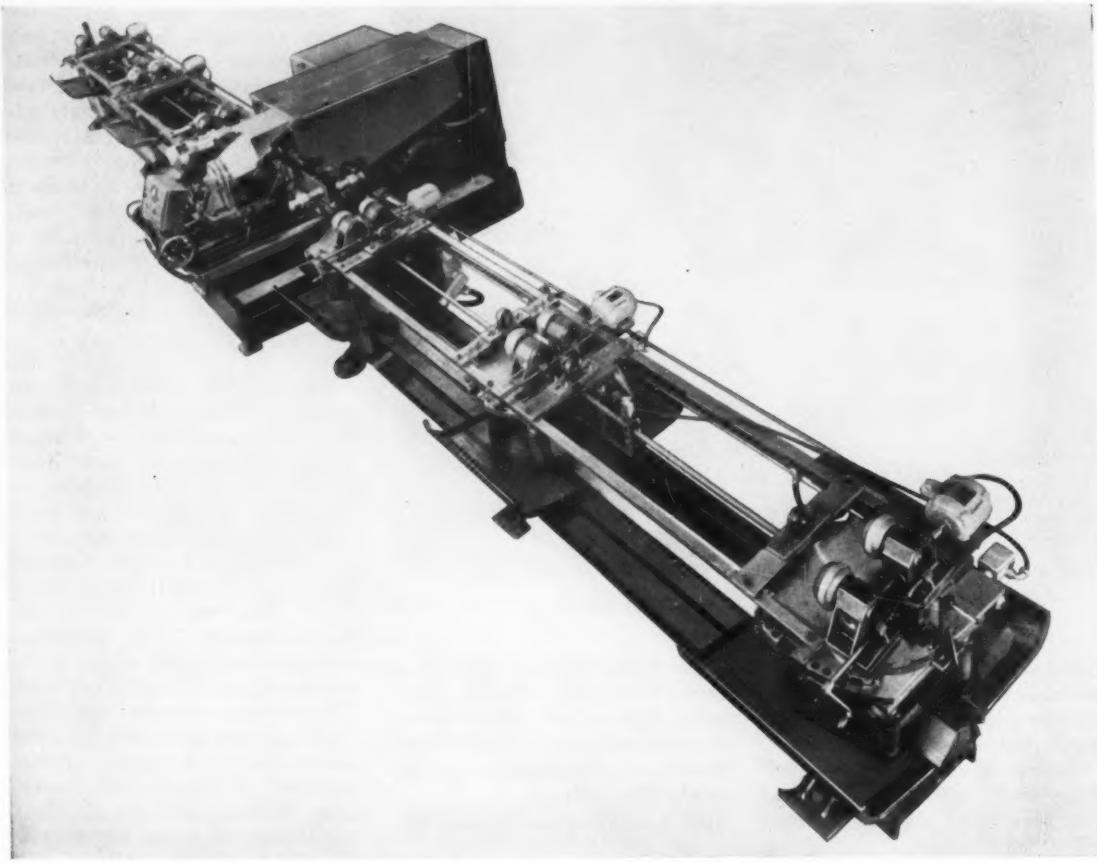

Fig. 1. Heavy-duty centerless belt grinder for precision grinding and finishing rod or tubular stock

## Engelberg Heavy-Duty Centerless Belt Grinder

Centerless belt grinders designed for precision grinding and finishing of rod or tube stock are being introduced by Engelberg, Inc., Syracuse, N. Y., in heavy-duty, standard, and long-bar models. The Model No. 8132-HD heavy-duty grinder, Fig. 1, features a large work-piece capacity, a powered outboard-support package, and an automatic reverse-feed mechanism. This machine will accommodate stock from 1 inch up to 9 inches in diameter, and up to any length. Average through-feed rates at a 4-degree helix angle setting of the regulating wheel and power-feed stands vary from 2 1/2 to 20 feet per minute. Advantages claimed for this model are: capacity for exceptionally heavy single-pass stock removal; production of quality finishes; and ability to hold extremely close tolerances on ferrous and non-ferrous metals as well as other materials.

The outboard-support mechanism has a main power unit with a 7 1/2-hp variable-speed motor.

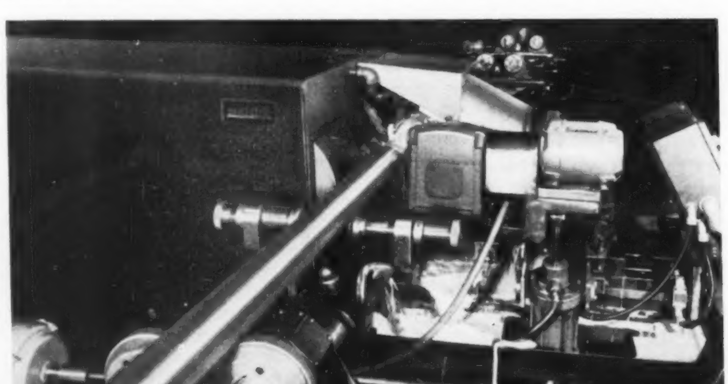

Fig. 2. Close-up of outboard supports on centerless belt grinder (Fig. 1)

This motor drives an alternating-current generator and seven 60-cycle, 1-hp maximum-output "slave" drive units. The slave units drive the regulating wheel and power feed stands. The power unit generates adjustable frequency alternating-current power which is fed to all the slave drive units. As the frequency generated by the power unit is adjusted, it causes the speed of all the slave motors to change at the same time. The frequency generated by the variable-speed power unit thus determines the speed of the slave units. The number of outboard-support stands is variable to suit work.

In a typical grinding sequence, tube or rod stock is loaded onto the outboard supports seen in the close-up view, Fig. 2, and is automatically presented to the abrasive belt for grinding by the powered supports working in conjunction with the regulating wheel. When the grinding cycle is completed the through-feed motion of the part trips a micro-switch control which may be stationed at any point along the outboard supports to accommodate work of the length being handled. This automatically changes the helix angle of the outboard-support power units, as well as the regulating wheel, causing the direction of the feed to be reversed. The number of subsequent grinding passes is determined by the amount of stock to be removed.

Stock-removal rates are high, the rate depending on the application. For example, in the processing of 416 stainless-steel bars, 5.060 inches in diameter by 10 feet in length, the machine removes 0.018 inch of stock per pass at a feed rate of 70 inches per minute or a total stock removal of approximately 3 pounds of metal per minute.

The abrasive belt is 8 by 132 inches and has a speed of 4500 surface feet per minute. Equipment includes an air-belt tensioning mechanism; a 50-hp belt drive unit with all electric controls; a complete recirculating system of 200-gallon capacity; a 1/2-hp coolant pump; and a regulating wheel 13 inches in diameter by 8 inches wide.

Circle Item 594 on postcard, page 197

## Hill Double-End Transfer Machine for Processing Ends of Tubular or Solid Stock

An automatic, double-end transfer machine that can perform up to six metal-forming or metalworking operations at high-production rates on each end of tubular or solid round stock is now available from Walter P. Hill, Inc., Detroit, Mich. This unit, equipped as shown, will handle stock up to 2 inches in diameter and will cycle at a maximum production rate of 3600 pieces per hour. Stock is fed to the machine conveyor from a magazine or factory conveyor, carried through the machining or forming stations by the transfer mechanism, and deposited on another exit conveyor or tote box in a completely automatic process. Such operations as milling, centering, boring, threading, deburring, cutoff, spinning, flaring, press-forming, forming, and de-dimpling can be performed in combination on ferrous or non-ferrous parts on this high-speed machine.

The hydraulically operated, electrically controlled machine consists of two opposed, motorized power heads mounted on a fabricated-steel base that encloses the hydraulic power unit and electrical-control panel. The heads can be positioned along the base on slides so that work in lengths varying from 1 foot to 10 feet can be handled by one machine. Parts up to 50 feet long can be processed on equipment of this type.

A transfer mechanism, consisting of a chain conveyor operated by a hydraulic cylinder-actuated, positive index mechanism, moves the parts from station to station between the two power heads. Each end of the chain conveyor is attached to a power head, thus providing automatic length adjustment for the transfer mechanism as the heads are moved apart or closer together to accommodate parts of different lengths. The parts are positioned in approximate machining location by the transfer mechanism. Hydraulic cylinder-operated clamps on the front of each of the power heads grip the outside diameter of the parts for accurate positioning in front of the machining or forming spindles.

Hill double-end transfer machines of the type shown are made in a variety of sizes within the basic design to suit individual part-production requirements. All electrical and hydraulic controls of this transfer machine conform to JIC standards.

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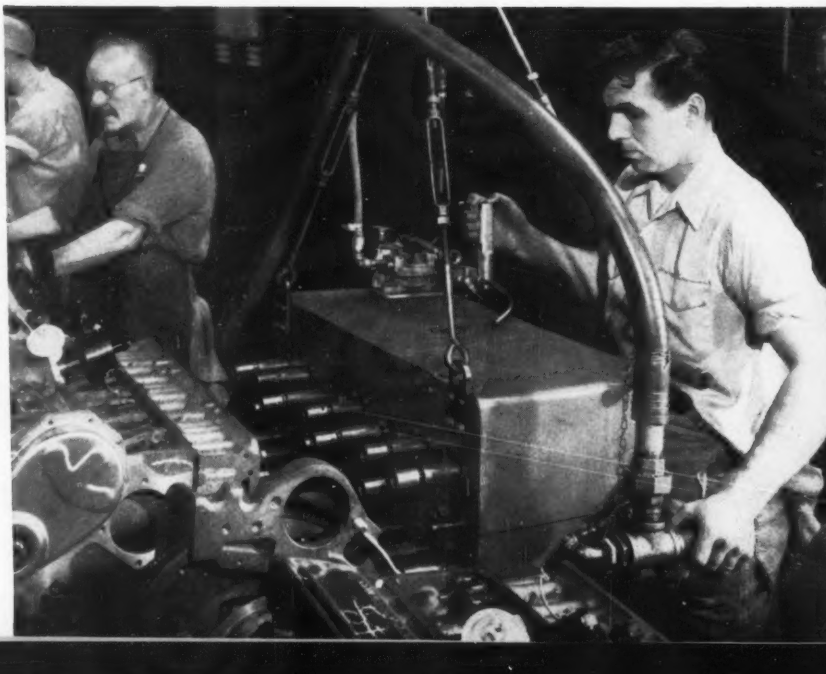
*(This section continued on page 190)*

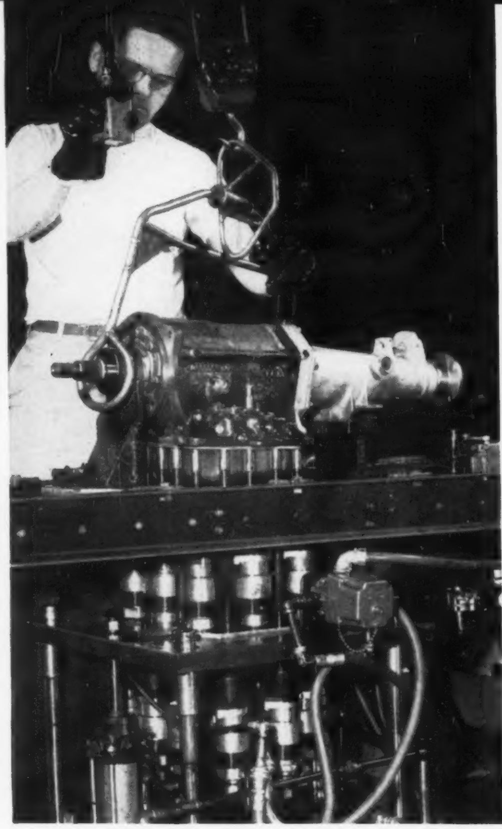
Hill double-end transfer machine equipped to spin and form both ends of stock for chair legs at a rate of 1200 pieces per hour

# YOU CAN

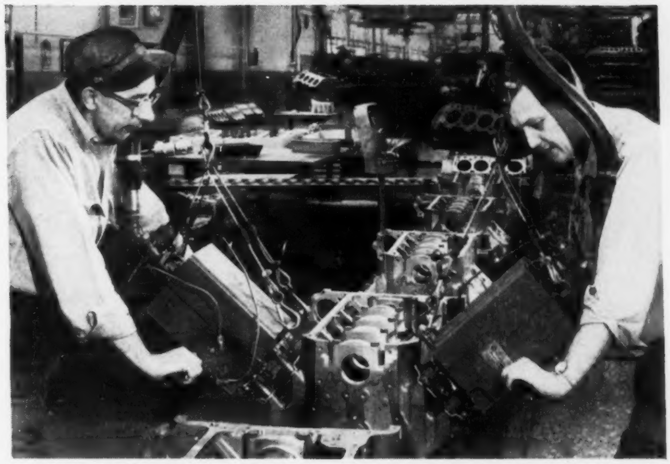
4-spindle Magnamatic Multi-runner.



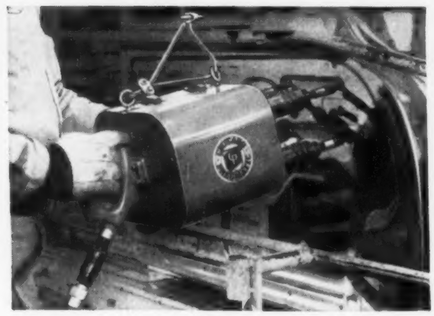
CP Multi-runner makes installing 18 cylinder head bolts a one-shot operation.



18-spindle Multi-runner drives 5/16" bolts on transmission oil pan assembly.



4-spindle Multi-runners make fast work of installing front motor mounts.



4-spindle Magnamatic Multi-runner sets cap screws on window regulator to uniform tightness, then releases instantly.

# PUT "EXTRA QUALITY" INTO YOUR PRODUCT when you use CP MAGNAMATIC Multi-runners

Put CP Magnamatic Multi-runners in the hands of your assembly operators and every fastener—on every unit—will be run to the proper torque. You don't have to do "follow-up" tightening by hand. You can spot check instead of checking every unit. You can hold your quality while you cut your time.

Even inexperienced operators drive nuts, bolts and studs to exactly the prescribed torque, because every Magnamatic spindle has a patented clutch that disengages when proper torque is reached. Despite variations in air pressure and motor wear, these clutch settings seldom require readjustment.

You can get Magnamatic Multi-runner units in five basic sizes, each adjustable within a wide range, handling torques from ½ to 350 foot pounds.

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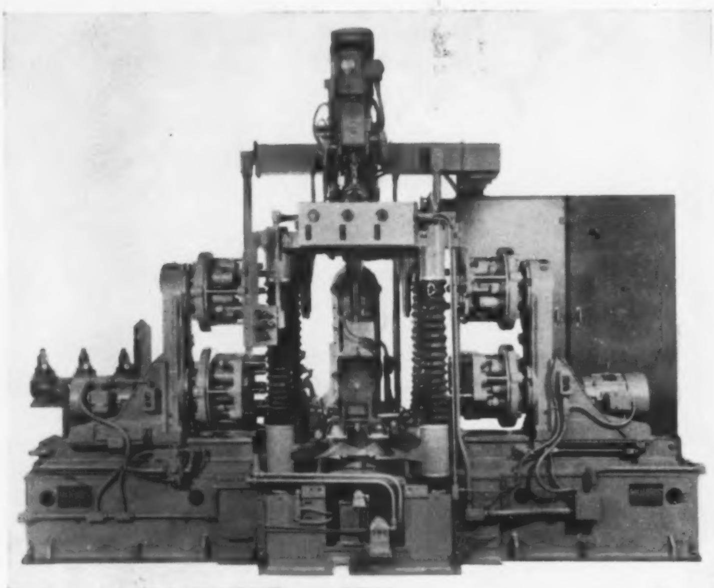


Morris four-way indexing, drilling, and tapping machine

## Morris Indexing, Drilling, and Tapping Machine

A four-way, vertical indexing, drilling, and tapping machine manufactured by the Morris Machine Tool Co., Cincinnati, Ohio, features a 20-inch square fixture-mounting area. This area is raised and lowered automatically to various machining stations. The equipment, developed for a motor manufacturer, accommodates ten different motor-frame bracket sizes (182 to 326). It utilizes three Morris 12-inch, way type hydraulic drill units and an Air-Oil-Matic drill unit equipped with a turret head. The machine performs 21 drilling and 21 tapping operations in one completely automatic cycle.

The operator simply loads the part into the fixture and presses the cycle starting button. In the lower position, the three-way type units drill and retract. After drilling a maximum of 20 holes in the first, second, and third stations, the machine indexes hydraulically in a vertical direction to the second position. The three-way type units in the upper sections drill and retract; the vertical Air-Oil-Matic unit drills, retracts, turret indexes, taps, retracts, and turret indexes to the original position. A maximum of 20 holes is tapped and one hole drilled at the four stations in the upper position. The machine then indexes back to the lower position and is unclamped for unloading.

The completely automatic cycle takes only 30.5 seconds. To adjust the fixture to the different frame sizes, the operator simply interchanges the fixture adapter plate, which compensates for the various center-line heights of the parts, and adjusts the clamping fingers. Slip spindle heads are utilized to facilitate altering of the various spindle centers required. Drill sizes range up to 5/8 inch in diameter.

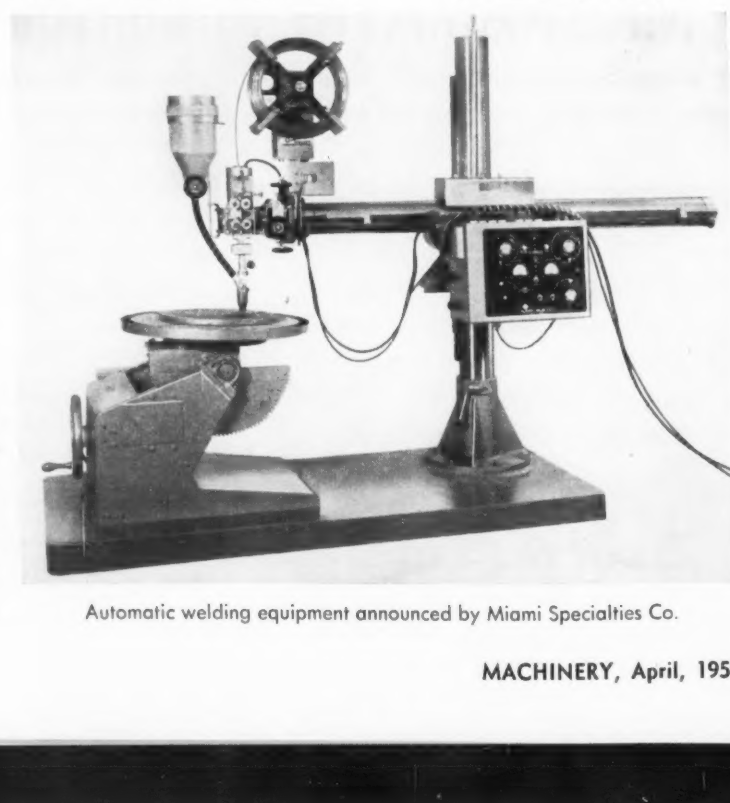
**Circle Item 596 on postcard, page 197**

## Automatic Welding Equipment

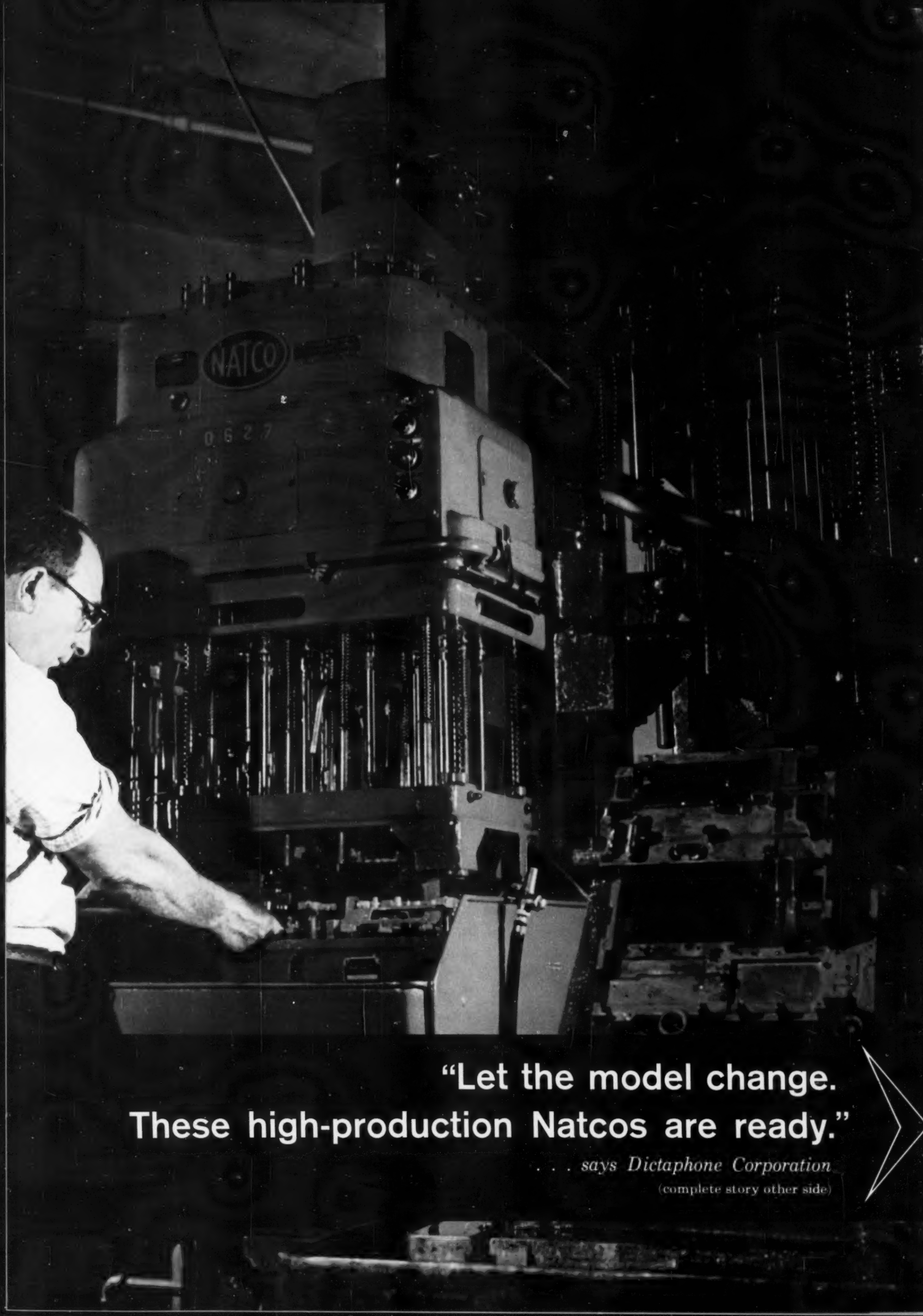
A very flexible manipulator is an outstanding feature of automatic welding equipment announced by Miami Specialties Co., Troy, Ohio. It consists of a vertical mast and horizontal boom mounted on a base of either the pedestal or cylindrical type. The boom is fabricated of tubular steel with machined, steel guideways and rack gear. It has infinitely adjustable travel speeds from 10 to 150 inches per minute and is powered by a 1/4-hp, 110-volt, direct-current motor. Maximum clearance of the boom is 42 inches and the effective weld length is 42 inches.

The mast is also made of tubular steel with a gear rack attached to provide for vertical movement of the boom on the mast. The vertical lift speed is 12 inches per minute through a double-worm, gear-reduction gear-box powered by a 1/4-hp, 110-volt direct-current motor. The mast will pivot 360 degrees and can be locked in any position. A limit switch prevents overtravel in the vertical down

*(Continued on page 202)*

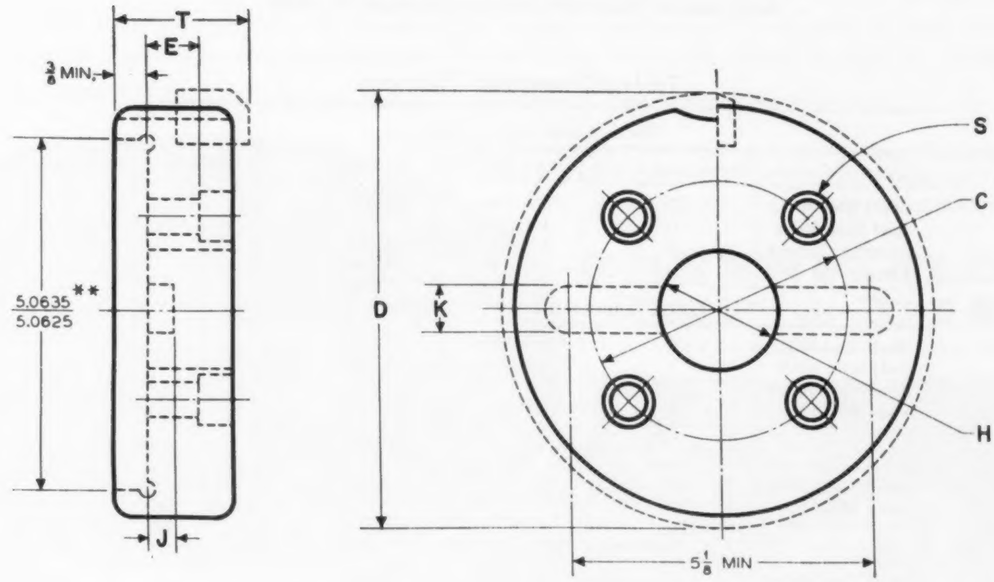


Automatic welding equipment announced by Miami Specialties Co.


NATCO
0627
"Let the model change.
These high-production Natcos are ready."
. . . says Dictaphone Corporation
(complete story other side)

## AMERICAN STANDARD INSERTED-BLADE MILLING CUTTER BODIES—5

**Approved as American Standard October 29, 1958**




### Table 5. Cutter Bodies for Face Mills with Inserted Blades Series 50

| General Dimensions | | | Driving Slot | | Bolt Holes | | | |
|---|---|---|---|---|---|---|---|---|
| Diameter of Cutter D | Width of Cutter T* | Diameter of Hole H | Width K | Depth J | Length of Bolt Holes Min. E | Diameter of Circle C | Drill and Counterbore Min. S | |
| 8 | 2 to 3⅜ | 2 | 1 | 17/32 | 7/8 | 4 | 21/32 | 29/32 |
| 9 | 2 to 3⅜ | 2 | 1 | 17/32 | 7/8 | 4 | 21/32 | 29/32 |
| 10 | 2 to 3⅜ | 2 | 1 | 17/32 | 7/8 | 4 | 21/32 | 29/32 |
| 12 | 2 to 3⅜ | 2 | 1 | 17/32 | 7/8 | 4 | 21/32 | 29/32 |

All dimensions given in inches.

*Optional with cutter manufacturer within range given.

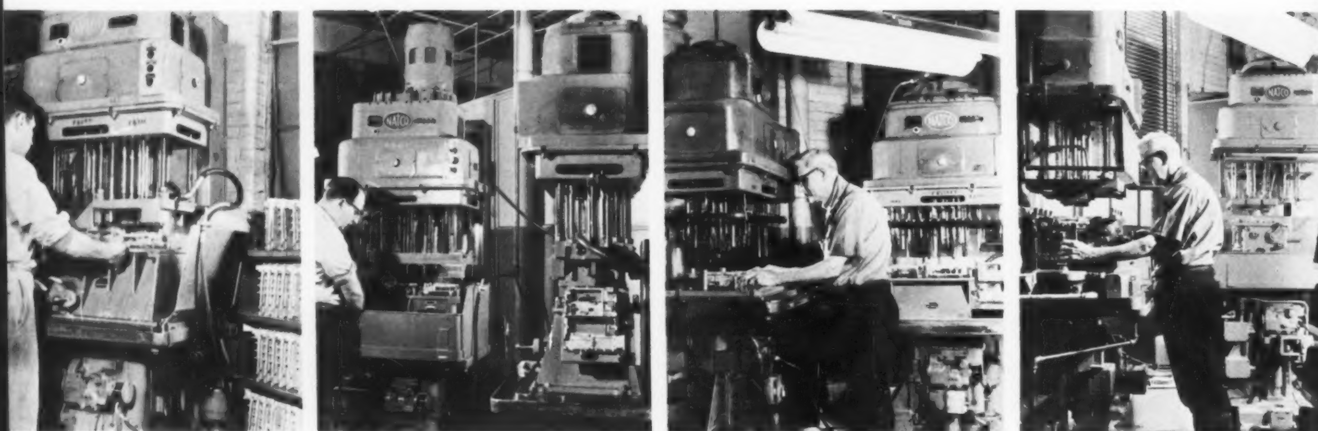
Tolerances are given on the following page.

---

Extracted from American Standard Inserted Blade Milling Cutter Bodies (ASA B5.23—1958), with permission of publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

# Five parts for the cost of one!

# Fast changeover too!



## These 7 standard Natcos do it for Dictaphone!

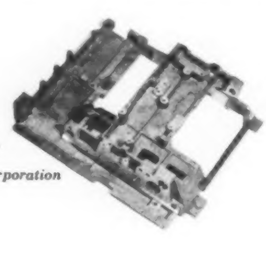
Costs toppled 81%, savings exceeded $1.00 per part when Dictaphone Corporation, Bridgeport, Conn., switched from gang drill production to this line of seven high-production H-6 Natcos. *Standards*, not specials. They quickly convert when models change; and replacement parts for old models can be run on the same line with minimum time for changeover.

Dictaphone's part is a magnesium main frame for its Time-Master dictating machine. It calls for drilling 97 holes and performing 150 secondary operations—reaming, tapping, counterboring and countersinking on most of them. The seven multi-spindle Natcos handle all but 16 of these operations.

Besides increasing production 81 per cent, the seven Natcos eliminate skipped and creeping holes, and maintain close tolerances. Natco tooling locates the magnesium parts without warping stresses.

On the Natco H-6, the slip plate is the key to flexibility. For example, Dictaphone transferred four Natcos from other assignments, simply by fitting them with new slip spindle plates and, of course, new fixtures. Three new Natcos filled out the line.

Natco H-6 and other multi-spindle drilling machines are available in models from 1 hp with 10 spindles to 50 hp with up to 72 spindles. Write today for complete details or see your Natco representative.



Under the cover of the Time-Master *, . . . profits in 97 holes.

**Registered trademark of Dictaphone Corporation*

NATCO

NATIONAL AUTOMATIC TOOL COMPANY, INC., RICHMOND, IND.

## AMERICAN STANDARD INSERTED-BLADE MILLING CUTTER BODIES—5

**Approved as American Standard October 29, 1958**

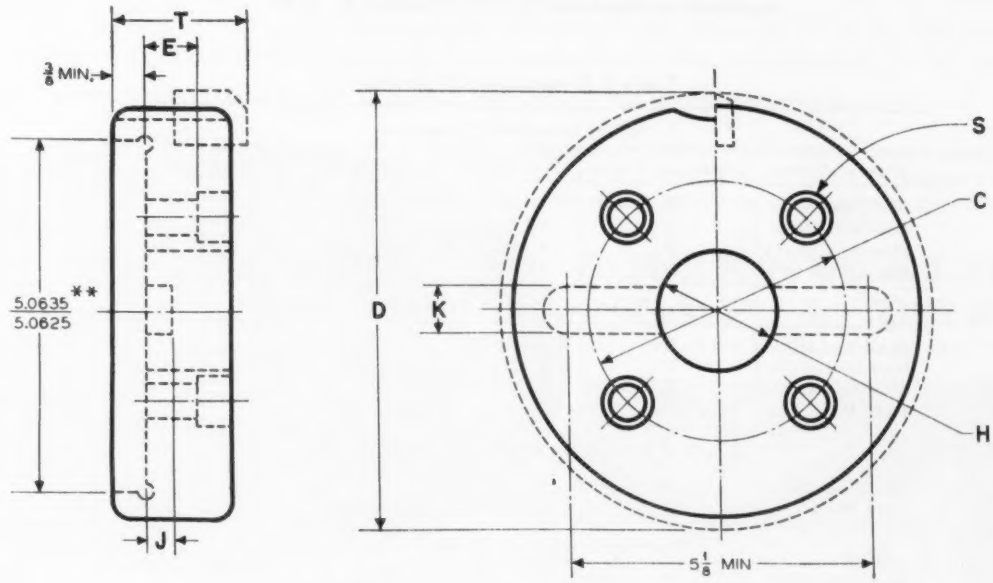



**Table 5. Cutter Bodies for Face Mills with Inserted Blades Series 50**

| General Dimensions | | | Driving Slot | | Bolt Holes | | | |
|---|---|---|---|---|---|---|---|---|
| Diameter of Cutter D | Width of Cutter T* | Diameter of Hole H | Width K | Depth J | Length of Bolt Holes Min. E | Diameter of Circle C | Drill and Counterbore Min. S | |
| 8 | 2 to $3\frac{3}{8}$ | 2 | 1 | 17/32 | 7/8 | 4 | 21/32 | 29/32 |
| 9 | 2 to $3\frac{3}{8}$ | 2 | 1 | 17/32 | 7/8 | 4 | 21/32 | 29/32 |
| 10 | 2 to $3\frac{3}{8}$ | 2 | 1 | 17/32 | 7/8 | 4 | 21/32 | 29/32 |
| 12 | 2 to $3\frac{3}{8}$ | 2 | 1 | 17/32 | 7/8 | 4 | 21/32 | 29/32 |

All dimensions given in inches.

*Optional with cutter manufacturer within range given.

Tolerances are given on the following page.

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Extracted from American Standard Inserted Blade Milling Cutter Bodies (ASA B5.23–1958), with permission of publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.

## AMERICAN STANDARD INSERTED-BLADE MILLING CUTTER BODIES—6

**Approved as American Standard October 29, 1958**

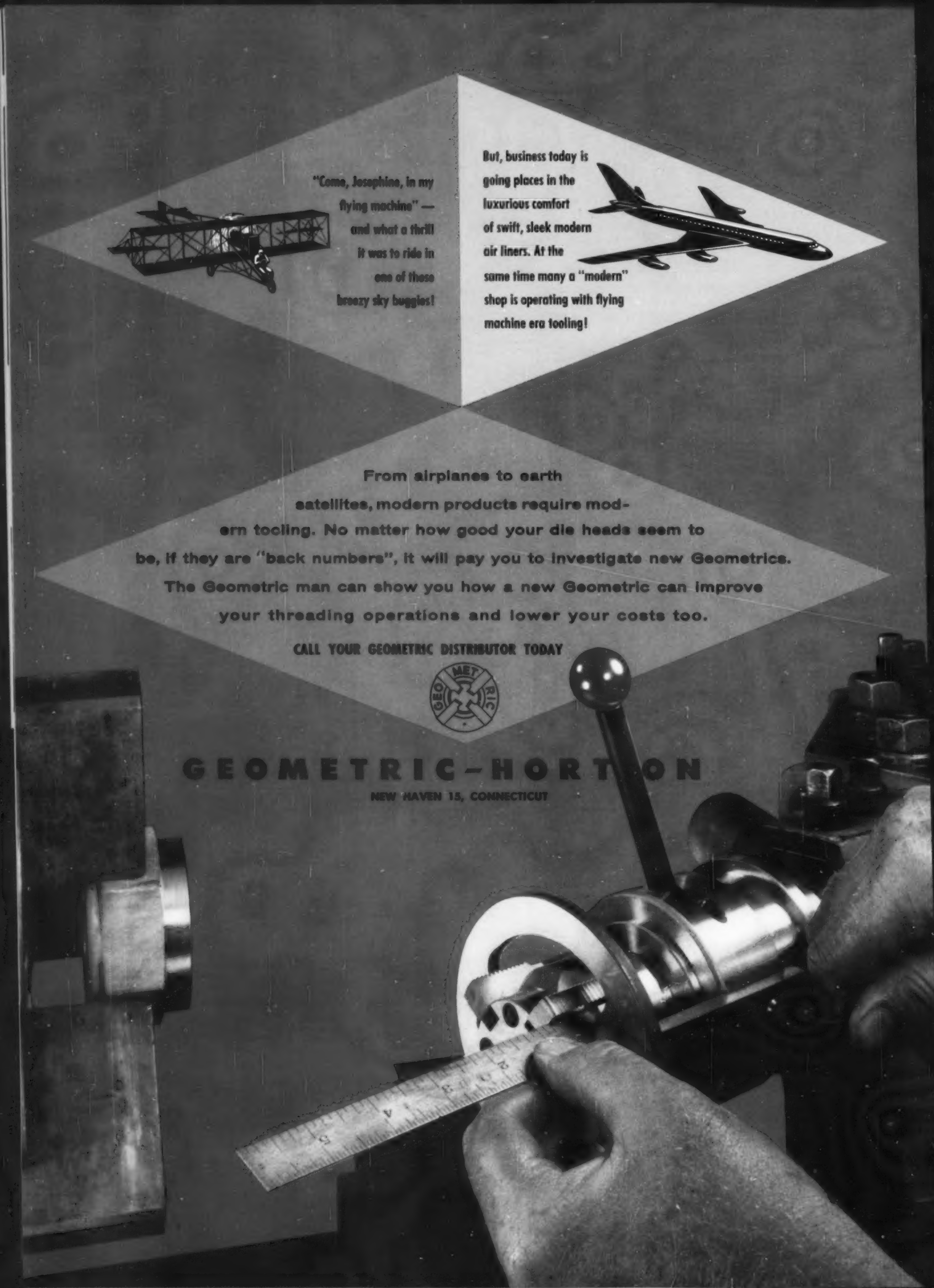
### Table 6. Dimensional Tolerances

| Type of Cutter | Dimension Letter | Size Range | Direction | Tolerance |
|---|---|---|---|---|
| **Outside Diameter, Tolerances** | | | | |
| Shell End Mills | D | All Sizes | Plus | 1/8 |
| Half Side Mills | D | All Sizes | Plus | 1/8 |
| Slotting Cutters | D | All Sizes | Plus | 1/8 |
| Face Mills | D | All Sizes | Plus | 1/8 |
| **Cutter Width (or Length), Tolerances** | | | | |
| Shell End Mills | T | All Sizes | Plus | 1/8 |
| Half Side Mills | T | All Sizes | Plus | 1/8 |
| Slotting Cutters | T | All Sizes | Plus | .002 |
| Face Mills | T | All Sizes | Plus | 1/8 |
| **Length of Bearing (or Bolt Holes), Tolerances** | | | | |
| Shell End Mills | E | All Sizes | Plus | 1/32 |
| Face Mills | E | All Sizes | Minus | 0 |
| **Diameter of Hole, Tolerances** | | | | |
| Shell End Mills | H | All Sizes | Plus | .001 |
| Half Side Mills | H | All Sizes | Plus | .001 |
| Slotting Cutters | H | All Sizes | Plus | .001 |
| Face Mills | H | All Sizes | Plus | .001 |
| **Drive Slot, Width, Tolerances** | | | | |
| Shell End Mills | K | All Sizes | Plus not less than | .008 |
| | | | Plus not more than | .012 |
| Face Mills | K | All Sizes | Plus not less than | .008 |
| | | | Plus not more than | .012 |
| **Drive Slot, Depth, Tolerances** | | | | |
| Shell End Mills | J | All Sizes | Plus | 1/64 |
| Face Mills | J | All Sizes | Plus | 1/32 |

All dimensions given in inches.

These tolerances apply to dimensions given in Tables 1 to 5.

Extracted from American Standard Inserted Blade Milling Cutter Bodies (ASA B5.23–1958), with permission of publisher, the American Society of Mechanical Engineers, 29 W. 39th St., New York 18, N. Y.


"Come, Josephine, in my flying machine" — and what a thrill it was to ride in one of these breezy sky buggies!
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## NEW CATALOGUES

**ALUMINUM** — Reynolds Metals Co., Richmond, Va. Booklet providing complete data on machining practices, tool angles and designs, and tool materials for use in the machining of aluminum. Proper speeds, feeds, lubricants, and cutting compounds are explained fully. Copies of "Machining Aluminum" can be obtained by writing on company letterhead to Reynolds Metals Co., Dept. PRD-3, Box 2346, Richmond 18, Va.

**MULTIPLE-PURPOSE UNIT**—Kearney & Trecker, Milwaukee, Wis. Manual entitled "How to Evaluate MILWAUKEE-MATIC," giving information on how to evaluate a new tool and its concept versus present conventional machines and methods. Copies are available to persons requesting it on their company letterhead from Kearney & Trecker, 6784 W. National Ave., Milwaukee 14, Wis.

**GROUND FLAT STOCK**—Industrial Products Division, Brown & Sharpe Mfg. Co., Providence, R. I. Bulletin No. M80, a combination catalogue and price list showing the availability of the company's complete line of precision-ground tool steel and low-carbon ground flat stock. It describes characteristics and benefits of the exclusive "Ready Mark" precision-ground tool steel, pre-colored blue for oil-hardening and maroon for air-hardening, and available at no price premium over the cost of plain tool steel . . . . . . . . **501**

**CUTTING TOOLS**—Kennametal Inc., Latrobe, Pa. 64-page pocket booklet (Manual No. 7), designed to help machine operators, tool-layout and tool-maintenance men in the selection, application, and maintenance of the company's cemented-carbide cutting tools, which has been reprinted in a 1959 edition. Principal changes and additions include revision of the grade and cutting-speed table to incorporate harder carbide grades, and revised recommendations for machining various materials. . . . . . . . . . . . . . **502**

**AUTOMATION EQUIPMENT** — Radio Corporation of America, Industrial and Automation Division, Detroit, Mich. Folder containing descriptions and specifications of a wide variety of "building-block" type automation machines for mechanizing and integrating production and assembly operations. These include floor feeders and orientors, rotary hoppers, self-compensating grinder controls, etc. . . . . . . . . . . . . . . . . . . . . . . . **503**

**ABRASIVE-RESISTANT ALLOYS** — Climax Molybdenum Co., Division of American Metal Climax, Inc., New York City. Booklet entitled "The Role of Molybdenum in Abrasion Resistant Materials" describes in detail the three general types of abrasive wear—gouging, grinding, and scratching. The proper selection of material for particular types and conditions of wear is also covered. . . . . . . . . . . **504**

**SWITCH DEVICES**—Micro Switch, Freeport, Ill., a division of Minneapolis-Honeywell Regulator Co. Catalogue 67, titled "Series 2 Lighted Indicator and Pushbutton Switch Devices," describing modern, efficient control panels, a new system of devices offering versatility in combined indication and control. Parts simply snap together to form combination switch-indicator devices. . . . . . . **505**

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**ELECTROLYTIC MACHINING**—Anocut Engineering Co., Chicago, Ill. Bulletin No. 130, presenting information on resharpening of milling cutters. It gives data on how Anocut cuts costs of cutter grinding, how the company facilitates installation of its automatic, electronically controlled power-supply unit, etc. . . . **507**

**ALLOYS**—Haynes Stellite Co., Division of Union Carbide Corporation, Kokomo, Ind. Booklet presenting corrosion-resistance properties of Haynes alloys. Charts and graphs show penetration rates for the alloys in over 250 corrosives. The booklet provides a quick reference for Hastelloy alloys, Haynes alloy No. 25, and Multimet alloy. . . . . . . . . . . . . . . . . . . . **508**

**PNEUMATIC GRINDERS**—Thomas C. Wilson, Inc., Long Island City, N. Y. Catalogue PT-58, providing data on the company's recently introduced line of portable pneumatic grinders with auxiliary equipment. The new line, including both powerful horizontal grinders and high-speed die grinders, is designed for a wide range of industrial operations. **509**

**BEARING LUBRICATION** — Miniature Precision Bearings, Inc., Keene, N. H. Manual discussing lubrication of miniature instrument bearings. It is the first of its kind in the miniature-bearing industry. It supplies data and information concerning the various types and brands of oils and greases available to bearing designers and users. . . . . . . . . . . . . . . **510**

**AVAILABLE FACILITIES**—Textile Machine Works, Reading, Pa. Booklet presenting a complete line of machine tools: milling machines, lathes, and chucking equipment, boring machines, drills, screw machines, etc. It also gives information on TMW's foundry with its hot blast cupolas, gas and electric furnaces, etc. **511**

**GRINDING AND BUFFING**—Cincinnati Electrical Tool Co., Cincinnati, Ohio. Catalogue 59, containing descriptive information, illustrations, and specifications on pedestal, snagging, disc, and lathe grinders, as well as carbide tool grinders, buffing and polishing lathes, dust collectors, etc. . . . . . . . . . . . . . **512**

**CARBIDE TOOLS**—Willey's Carbide Tool Co., Detroit, Mich. Catalogue MT-059, presenting carbide-tool products and giving complete data and prices for solid-carbide standard blanks, indexable "throw-away" inserts, on-end inserts, Willey's Pentagon indexable inserts and tool-holders, and standard "brazed-on" single-point tools. . . . . . . . . . . . . . . **513**

**ALLOYS AND ALUMINUM**—Reynolds Metals Co., Richmond, Va. Brochure featuring the company's aluminum mill products, giving complete specifications for the hundreds of alloys and forms of aluminum available. A bibliography provides a guide to related literature and movies also available from Reynolds. **514**

**HYDRAULIC COMPONENTS**—Lenz Co., Dayton, Ohio. Catalogue featuring flow charts, JIC piping, and helpful information for engineering and maintenance departments. It contains complete data on the Lenz O-ring seal tube fittings, flare fittings, pipe fittings, tube benders, and other hydraulic components. . . . . . . **515**

**VERTICAL FOUR-SLIDE**—Machine Division, Torrington Mfg. Co., Torrington, Conn. Bulletin UB-3 Verti-slide vertical four-slide machine. The UB-3 features advantages in high production, accuracy, and rapid setup previously difficult to obtain in this type of wire-forming equipment. A specifications table is included. . . . . . . . . . . . . . . . . . . . . . **516**

**CUTTING FLUID**—E. F. Houghton & Co., Philadelphia, Pa. Folder entitled "The Evolution of a Modern Cutting Fluid," describing the development of coolants from water to oil to fortified petroleum bases, then to heavy-duty, water-soluble concentrates, and now to chemically conceived coolants containing no petroleum. "Hocut 237" is the new product featured. . . . . . . . . . . . . . . **517**

**GEAR FINISHER**—Michigan Tool Co., Detroit, Mich. Bulletin 870-C-58, presenting a number of new design features that improve the operation of the company's 870-C internal-gear finisher. It describes how this machine can be used for either conventional transverse or plunge shaving of internal gears. . . **518**

**ALLOY**—Haynes Stellite Co., Division of Union Carbide Corporation, New York City. Booklet pertaining to "Hastelloy" alloy C. Chemical, physical, and mechanical properties, along with a guide to corrosion resistance, are presented through the use of charts and graphs. High-temperature properties are given. . . . . . . . . . . . . . . . . . . . . . . . . **519**

**GEAR SHAVING**—Michigan Tool Co., Detroit, Mich. Brochure (870-A-58), describing two rotary, external-gear finishing machines. Underpass, modified underpass, and transverse gear-shaving methods are illustrated and a short discussion on crown shaving is presented. . . . . . . . . . . . . . . . . . . . . . **520**

**FASTENERS**—Midland Screw Corporation, Chicago, Ill. Folder illustrating standard, special, aircraft, and packaged fasteners. It also shows Midland's cold-heading facilities and plant locations. Color illustrations are supplied. . . . **521**

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**PRESSES**—K. R. Wilson, Inc., Arcade, N. Y. Bulletin No. 95-D, introducing the modernized and expanded line of KRW four-column, single-action hydraulic presses. Specifications are given for forty-eight models (either up-acting or down-acting) ranging in capacities from 25 to 1000 tons. . . . . . . . . . . . . . . . . . . . .**522**

**AIR CONTROL VALVES**—Hannifin Co., Des Plaines, Ill. Catalogue, entitled "Valve Finder," featuring an informative discussion of air valves and their selection together with condensed catalogue listing of all Hannifin valves. . . . . . .**523**

**DIAMOND WHEELS** — Carborundum Company, Niagara Falls, N. Y. Brochure on diamond wheels (both natural and man-made diamonds) for carbide grinding; deals with bond types, infeed and table feeds, wet-grinding, etc. . . . . .**524**

**TURRET LATHES**—Kaukauna Machine & Foundry Division, Giddings & Lewis Machine Tool Co., Kaukauna, Wis. Booklet describing vertical turret lathes and their advanced features, consisting of full directional controls, non-metallic saddle bearing, etc. . . . . . . . . . . . . . . . . . .**525**

**CARBIDES**—Unimet Carbides, Chicago, Ill. Catalogue No. A-102, featuring complete performance data on regular low-cost and premium grades of carbide tools, tips, inserts, and blanks, as well as information on special shapes and wear parts. . . . . . . . . . . . . . . . . . . . . . .**526**

**BORING-BARS**—Wesson Co., Detroit, Mich. Bulletin MB-1158, describing more than 114 standard boring bars. This booklet gives all specifications for two lines of micro-adjustable and two lines of non-adjustable boring-bars. . . . . . . .**527**

**THREAD-ROLLING HEADS**—Landis Machine Co., Waynesboro, Pa. Bulletin F-99-1, formerly incorporating information on only the No. 5 series, now including details on the No. 7 series stationary and revolving heads having a right-hand range of 7/16- to 7/8-inch N.C. and N.F. . . . . . . . . . . . . . . . . . . . . . . .**528**

**BELT DRIVES**—Gates Rubber Co., Denver, Colo. Catalogue DH-900, entitled "The Modern Way To Design V-Belt Drives," providing complete drive-design information on the new concept in power transmission—the compact Super HC V-Belt Drive. . . . . . . . . . . . . . . . . . . .**529**

**CYLINDERS**—Petch Mfg. Co., Detroit, Mich. Brochure presenting standard and special hydraulic and pneumatic cylinders, and other related products. It also describes a new concept in hydraulic-valve panel fabrication by building-block components. . . . . . . . . . . . . . . . . . .**530**

**FINISHING SYSTEMS**—Industrial Equipment Division, R. C. Mahon Co., Detroit, Mich. Catalogue A-659, presenting a complete finishing system and featuring typical custom installations already in operation in automotive, appliance, and other industrial plants. . . . . . . . . . .**531**

**UNIVERSAL JOINTS**—Curtis Universal Joint Co., Springfield, Mass. Catalogue covering an entire line of single and double universal joints, complete with prices, specifications, and instructions for disassembly, reassembly, and lubrication. . . . . . . . . . . . . . . . . . . . . . . .**532**

**GRINDING WHEELS**—Chicago Wheel & Mfg. Co., Chicago, Ill. Bulletin No. 7525, giving complete range of sizes and shapes of grinding wheels. It includes vitrified, resinoid, and rubber bonds in cutoff, straight, recessed, and plate-mounted wheels. . . . . . . . . . . . . . . .**533**

**DISC GRINDING**—Besly-Welles Corporation, South Beloit, Ill. Bulletin DH4, giving data on the DH4 double horizontal-spindle disc grinder which was recently added to the company's line of precision disc grinders. This machine makes disc grinding virtually automatic. . . . . . .**534**

**HOISTS AND CRANES**—Wright Hoist Division, American Chain & Cable Co., Inc., York, Pa. Folder DH-28, illustrating the Wright line of motor-driven cranes. . . . . . . . . . . . . . . . . . . . . . . . . . . . **535**

**GRINDING WHEELS**—American Emery Wheel Works, Providence, R.I. Brochure presenting characteristics of the company's grinding wheels, and recommendations for their use. Specifications and tables are given. . . . . . . . . . . . . . . .**536**

**JIG GRINDER**—Moore Special Tool Co., Inc., Bridgeport, Conn. Brochure demonstrating the locational accuracy of the No. 3 Moore precision jig grinder. . .**537**

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**SAWING MACHINE**—DoALL Co., Des Plaines, Ill. Brochure describing the "Pan-Arm" contour sawing machine for fast, economical, heavy machining. The articulated cutting head concept is explained in detail. . . . . . . . . . . . . . . **539**

**SURFACE PLATES**—Pratt & Whitney Co., Inc., West Hartford, Conn. Booklet presenting a line of precision granite surface plates, as well as straightedges, parallels, angle-plates, and stands. . . . . . . . . . **540**

**TAPPER**—Procunier Safety Chuck Co., Chicago, Ill. Circular containing detailed information on a lead-screw tapping unit. It gives specifications, operating instructions, and available accessories. . . . **541**

**PUNCHING PRESS**—Minster Machine Co., Minster, Ohio. Bulletin No. 13, discussing Minster Series 20 deep-throat punching presses for light and medium cutting, punching, and flanging operations on large pieces. . . . . . . . . . . **542**

**HYDRAULIC DRIVES**—Twin Disc Clutch Co., Racine, Wis. Bulletin No. 314, giving condensed specifications on all of the company's friction and fluid drives. . . . . . . . . . . . . . . . . . . . . . . . . . **543**

**BRAZING ALLOY**—Wall Colmonoy Corporation, Detroit, Mich. Engineering data sheet (Number 5) discussing W. G. Nicrobraz, a nickel-base brazing alloy for joining stainless-steel surfaces with large clearances. . . . . . . . . . . . . . **544**

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**MACHINE INSTALLATION** — Unisorb Division, Felters Co., Boston, Mass. Engineering-Data folder providing information on simplified machine installation and vibration control. . . . . . . . . . . **545**

**FLEXIBLE SHAFTS**—Stow Mfg. Co., Binghamton, N. Y. Bulletin No. 590, giving data on the Stow high-speed, power-drive flexible shafting. It also gives complete dimensional data on all sizes. **546**

**TAPE-CONTROLLED DRILLING MACHINE**—Burg Tool Mfg. Co., Inc., Gardena, Calif. Bulletin featuring the Burgmaster GE tape-controlled turret drilling, tapping, and boring machine having six and eight spindles. . . . . . . . . . . . . **547**

**"BUILDING-BLOCK" TOOLS**—Cleveland Hobbing & Machine Co., a division of Textron Inc., Cleveland, Ohio. Bulletin announcing a line of machine tools designed and manufactured on the "building-block" principle. . . . . . . . . . . . **548**

**LUBRICATION AND TUBE-FORMING**—Eynon-Dakin Co., Detroit, Mich. Catalogue 59B, featuring a line of oilers, lubricating devices, and special tube-forming facilities. . . . . . . . . . . . . . . . . **549**

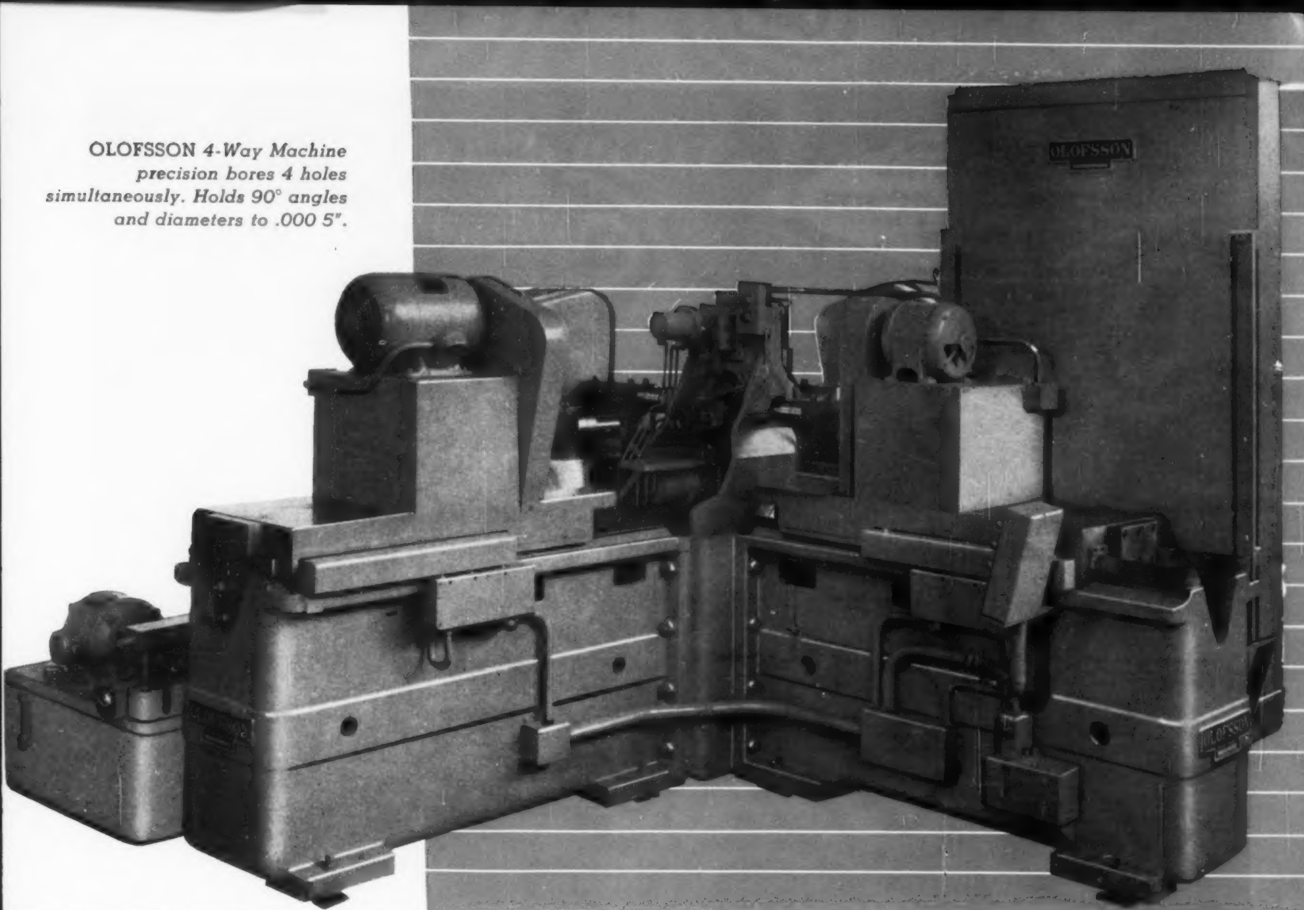
**BENCH PRESS**—Geo. T. Schmidt, Inc., Chicago, Ill. Circular presenting new applications of the Model 10-T "Pneumark," a versatile, as well as economical, impact bench press. . . . . . . . . . . . **550**

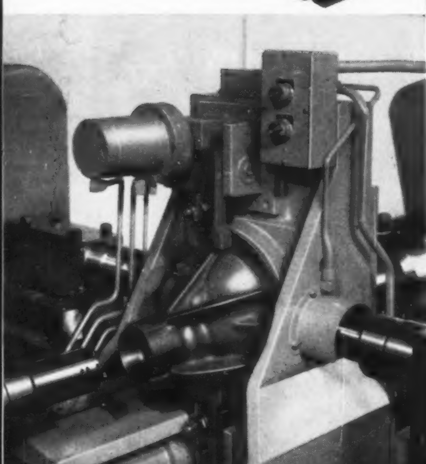
**TOOLING PLATE**—Kaiser Aluminum & Chemical Sales, Inc., Chicago, Ill. Brochure describing the company's rolled tooling plate used to make industrial tools, jigs, and fixtures. . . . . . . . . . . **551**

**CONTROL VALVES**—Hunt Valve Co., Salem, Ohio. Bulletin No. 581, featuring Hunt "Slim Line" control valves. . . . **552**

**GAGES**—Moore Products Co., Philadelphia, Pa. Bulletin 8008, presenting Moore pneumatic comparator gages. **553**

OLOFSSON *4-Way Machine precision bores 4 holes simultaneously. Holds 90° angles and diameters to .000 5".*



*Close-up view of differential carrier, hydraulically cam-clamped in position for boring.*

## for MORE production and precision, combine 2, 3, or 4 OLOFSSON way units in any COMBINATION

OLOFSSON Precision Way Machines perform fast, accurate boring, facing, turning, grooving, and chamfering. Units are electrically interlocked, and the spindles move to the work.

For long, dependable, and accurate operation Olofsson Way Units feature:

- **Single push-button control panel.**
- **Hardened and ground V-style ways.**
- **Hydraulic control Valves, manifold mounted and located with reservoir.**
- **Parker Majestic precision boring spindle.**
- **Rigid ribbed, nickle iron base.**
- **Adherence to latest J.I.C. recommendations.**
- **Hydraulic pump units located outside base.**
- **Automatic central lubrication system.**
- **Dwell time not affected by positive stop screw adjustment.**

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MANUFACTURERS OF PRECISION BORING MACHINES AND SPECIAL MACHINERY

position. The pedestal base is heavy sheet steel, rigidly reinforced, and measures 36 inches wide, 72 inches long, and 4 1/4 inches high. A control panel (optional equipment) provides for speed control of the horizontal movement, forward - and - reverse switching, up-and-down switching, and a control power ON-OFF switch.

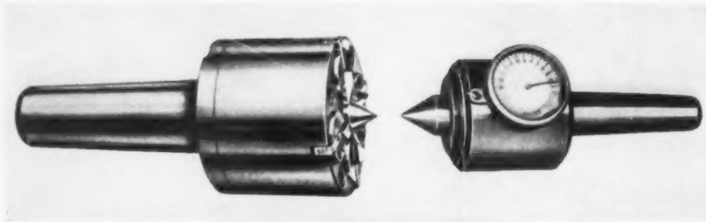
Circle Item 597 on postcard, page 197

## Die Sets with Aluminum Retainers

Die sets with ball-bearing guide pins made by Lempco Industrial, Inc., Bedford, Ohio, are now available with special-alloy aluminum retainers for the ball bearings of the guide pins. The aluminum retainers are said to add to the already long life of Lempco die sets and to cut the bushing weight in half.

The patented Lempco ball-bearguide pin bushing is self-aligning, maintains alignment for millions of strokes, and requires a minimum of attention.

Circle Item 598 on postcard, page 197



Driving and live centers for turning and grinding work

## Work-Holding Centers for Turning and Grinding

A recently developed combination of driving center and live center that is said to provide a completely effective method of holding material between centers for turning and grinding is available from the R. B. Tool Co., Inc., Palisades Park, N. J. This combination includes the company's hydromechanical driving center and compensator live center with builtin pressure gage.

The conical center point of the driving center is spring-loaded independent of the hydraulic system to provide the highest degree of concentricity. Interchangeable driving pins in eight different sizes permit the clamping of material from 1 inch to 10 inches in diameter with but one driving center.

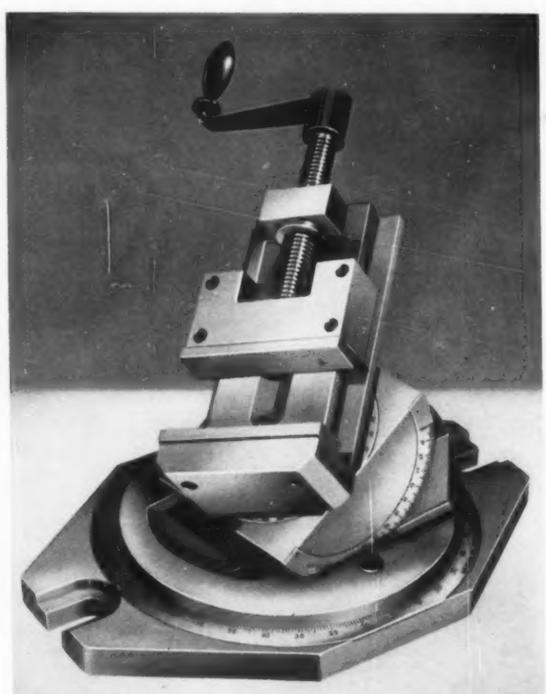
The spring-loaded live center has a built-in pressure gage to provide constant visual indication of the exact amount of axial load on the center. Use of this gage on the compensator live center prevents its overloading, as it compensates for heat expansion and axial thrust of the driving center.

Circle Item 599 on postcard, page 197

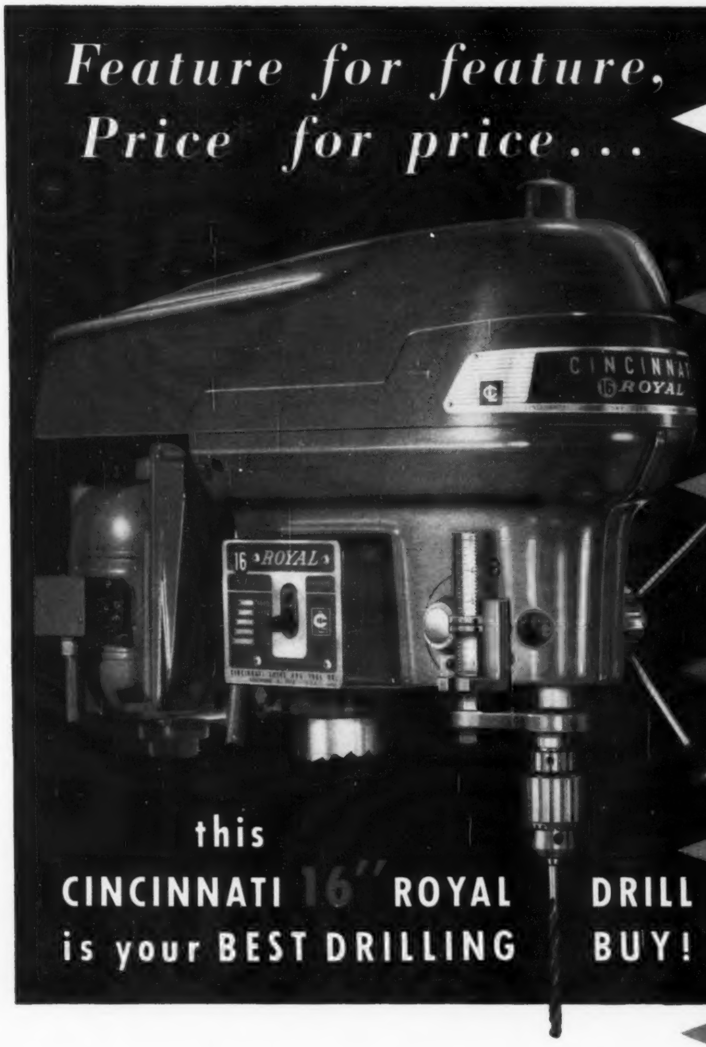
## Universal-Angle Vise

A Model "1A" Wesson universalangle vice is manufactured by the Wesson Co., Detroit, Mich. This device is designed to combine ex-

Lempco die set with aluminum retainers for ball-bearing guide pins



Wesson universal-angle vise of high precision and low over-all height




**CHECK LIST FOR DRILLING AT A PROFIT**

**SPINDLE ACCURACY**
6-spline spindle mounted in 4 precision bearings—one at TOP and bottom of spindle pulley.

**BUILT-IN ELECTRICS**
Complete controls with overload protection built into the head.

**POSITIVE DEPTH GAGE**
Easy-to-read gage is graduated in 1/64". Quickly set for positive stop at desired position.

**RAPID SPEED CHANGE**
Tilting motor bracket provides easy belt shifting for five spindle speeds.

**SPACIOUS TABLES**
Large working surface of tables and bases, with massive 3" column design provide unusually wide work range.

**APPEARANCE**
Streamlined functionally for maximum safety and operating ease.

**ACCESSORIES**
Profit-boosting attachments and accessories include automatic air feeds, electrical tapping units, motor driven coolant pump, and others.

The CINCINNATI 16" ROYAL Drill is a real metal-working drill, built to machine tool quality standards by a machine tool builder. This is a multi-purpose machine—it handles light drilling on a production basis, as well as being ideal for utility operations. With CINCINNATI quality built-in, a ROYAL holds its accuracy longer—stays on the job longer.

*Only $128 for the Cincinnati 16" Royal bench type drill shown. Complete with 0"—1/2" chuck or #2 M.T. spindle, built-in single phase manual control with overload protection—less motor. Floor model, as above, only $143.

ROYALS are built in bench and floor types, single and multiple spindle 16" models with 5/8" drilling capacity in cast iron. Also 18" models with 1" capacity in cast iron.

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*"TRAY-TOP" Lathes / "CINCINNATI" Drilling Machines / "SPIROPOINT" Drill Sharpeners*

treme rigidity, high protection, and low over-all height. It is only 5 1/4 inches high, has a jaw capacity of 4 inches, and is claimed to be the most compact, precision three-way fixture available. It can be used for compound, heavy, medium, or light-duty milling, drilling, boring, and grinding operations. A new wedge type locking arrangement assures setup rigidity with torque loading up to 3000 pounds. The sturdy base is 12 inches long by 8 5/8 inches wide. All graduations are accurate to plus or minus 15 minutes of angle and are clearly marked on stainless-steel rings for easy reading. Three separate angular adjustments are: 360-degree rotation of the base; 90-degree vertical-range cradle adjustment; and 360-degree rotation of the jaw assembly.

**Circle Item 600 on postcard, page 197**

## Instrument for Sorting Metal Parts

Non-destructive testing and sorting of accidentally mixed or incorrectly processed metal parts can be done speedily by an instrument known as the Model C-2 Cyclograph, announced by the J. W. Dice Co., Englewood, N. J. This equipment can be used on either ferrous or non-ferrous metals and will sort raw stock, semifinished, or finished parts by their metallurgical characteristics such as analysis, hardness, structure, case depth, etc. With a known and acceptable part used as a "standard" in adjusting the instrument, unwanted parts are quickly separated from the good ones.

The Model C-2 Cyclograph can be used as a "hand" sorter, in which case the operator watches the screen and manually throws out the off-standard parts, or it can be used in conjunction with a Type 407 automatic relay unit. The relay unit eliminates operator discrimination and makes it possible to sort many more thousands of parts per day. Parts can be passed through the test coil on a belt conveyor or by other fast feeding means. The relay unit sends out a reject signal whenever an off-standard part passes through the test coil and this signal can be used to operate a solenoid-actuated reject gate, paint-spray marking device, or other reject means. The combination permits fully automatic, high-speed inspection.

Size and shape of the part presents no particular problem as test coils are wound for any size opening desired. Typical parts inspected are: bolts, nuts, screws, aircraft valves, roller bearings, AP shot, jet engine rotors, blades and other forgings, malleable castings, welding rod, automotive parts, steel and copper tubes, piston rings, ordnance items, and bar stock.

**Circle Item 601 on postcard, page 197**

## Spacing Drill for Structural Steel and Plate Fabrication Works

The Shlagro Steel Products Corporation, Somerville, Mass., has announced the development of a spacing drill for structural steel and plate fabrication that eliminates many steps in this work and offers all the advantages of a portable fabricating "shop." This "Shlagromatic" spacing drill, as shown in the illustration, consists of a unique carriage with flanged wheels adaptable in width and height and made to run along the flanges of the beam or girder. The frame has positive locking devices for accurate positioning. Three drills are carried by the frame. The drills are arranged about the beam so that a drill faces each of the flanges, with the third drill facing the web.

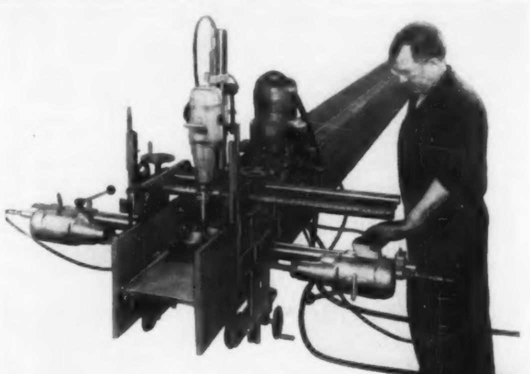
A pressure of 2000 pounds is applied to the drills by a power-hydraulic pump. The drills move transversely across the web and flange easily and smoothly. Measuring scales are built-in to indicate the precise position of the drills. The locating and drilling of holes requires no marking or center punching.

It can be used on any size rolled beam up to 36 inches or deeper built-up sections.

**Circle Item 602 on postcard, page 197**

*(This section continued on page 206)*

Cyclograph for sorting metal parts announced by the J. W. Dice Co.



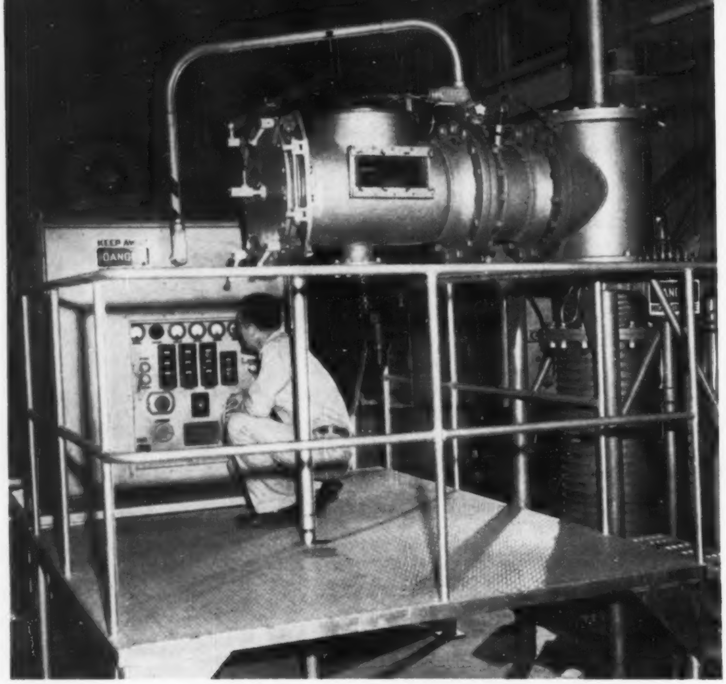
"Shlagromatic" spacing drill brought out by Shlagro Steel Products Corporation

## Electron-Beam Welder

An electron-beam welder which successfully joins reactive and high-melting-point metals used in critical missile and atomic-reactor applications has been designed and built by Air Reduction Co.'s Central Research Laboratories, Murray Hill, N. J. This unit applies a high-intensity electron beam to the welding of beryllium, molybdenum, tantalum, zirconium, hafnium, and all other exotic metals which before this could not be welded satisfactorily, or were very difficult to weld by conventional techniques.

Application of the electron-beam process requires custom-built equipment for specific jobs. In operation, an electron beam bombards the materials to be welded in a very high-vacuum chamber. The use of a high vacuum makes it impossible for the metals to be contaminated by the atmosphere during the welding process, a necessary condition for the effective welding of reactive metals. In fact, many of the contaminants that might be present in the original work-pieces are removed during the welding process. The size of the electron beam, as small as 1/16 inch in diameter, can be controlled to a degree previously unattainable. Resultant welds are said to be stronger and more ductile.

**Circle Item 603 on postcard, page 197**



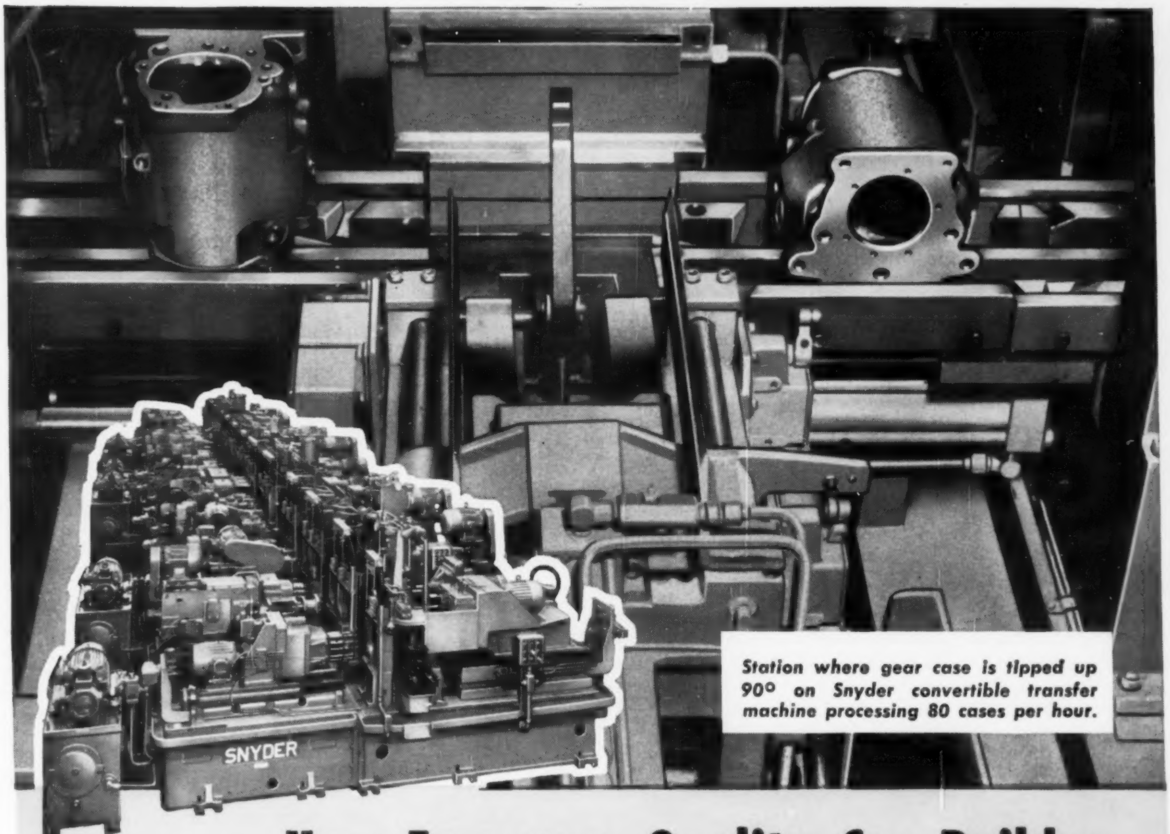
Electron-beam welder brought out by the Air Reduction Co.

## Bending and Straightening Machine

The Cleveland Punch & Shear Works Co., Cleveland, Ohio, has brought out a No. 2 model bending and straightening machine which features a welded-steel frame of streamlined design. This unit has all gears and the flywheel completely enclosed for safety. It has a capacity of 225 tons, a 1 1/2-inch stroke, and operates at a speed of twenty-eight strokes per minute. There is a 12-inch adjustment on the slide. The 60-inch center makes it possible to handle 24-inch standard I-beams either horizontally or vertically.

Machines of this type are also made in No. 1, No. 1 1/2, No. 1 1/2 HD (heavy-duty), and No. 1 3/4 models. These four sizes have capacities for bending or straightening 12-, 15-, or 18-inch standard I-beams, either horizontally or vertically. All are designed for continuous movement of the sliding head. Where intermittent

Cleveland I-beam bending or straightening machine for use in fabricating structural steel for bridges, buildings, and ships




Station where gear case is tipped up 90° on Snyder convertible transfer machine processing 80 cases per hour.

# How European Quality Car Builder Snyderizes for the Soaring Sixties

This new 53-station transfer machine combines special purpose efficiency with high convertibility for later changes. Part orienting devices enable Snyder to utilize standard horizontal way-type units to drill, spotface, chamfer, ream, line-ream, mill and bore this cast iron standard gear transmission case on all faces. The cases are turned 90° at the thirteenth station and tipped up 90° at the thirty-eighth station, which eliminates vertical machining units. The part is specifically located on faces not subject to future design changes, thus reducing future capital expenditure.

*　*　*

Let us show *you* how to SNYDERIZE FOR THE SOARING SIXTIES for more efficient parts handling, gaging, assembly and machining. Send or phone for new brochure with resume of Snyder machines engineered for profit improvement.

**Standard Features of Snyder Machines**

1. SNYDER SELF-CONTAINED UNITS and other units equipped with hardened and ground steel ways.
2. Threading and tap heads equipped with individual lead-screw spindles.
3. Minimum downtime for tool changes because spindles are arranged for pre-set cutting tools.
4. Automatic lubrication.
5. J.I.C. Standards throughout.
6. Electrical interlocks and full depth circuit throughout.
7. Panels equipped with SNYDER CIRCUIT SLEUTH.

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movement and fabrication action is desired, it is achieved on the smaller machines through the use of a treadle-operated, positive-jaw clutch. The No. 2 machine has a direct-connected motor drive and a separate motor and control that supply power to adjust the plunger. This power adjustment enables the operator to control the bending or straightening operations to the exact specifications for each job.

Circle Item 604 on postcard, page 197

## "Red Head" Self-Contained "Borizer" Unit

A completely self-contained "Red Head" unit for rotating and feeding single or multiple tools has been introduced by the Heald Machine Co., Worcester, Mass. This compact unit, called a "Borizer," generates its own hydraulic power and is used singly or in groups for drilling, reaming, counterboring, chamfering, plunge-facing, and similar operations. Using supported guide bushings, it can also do precision boring with either a single- or multiple-tool quill. The "Borizer" is designed to provide economical multiple tooling in automated or special setups in a wide variety of applications. It can be used for performing several single- or multiple-spindle operations in sequence by mounting several units—horizontally, vertically, or at any angle—either on a single base or an automated line.

The compact unit permits close mounting. Electrical controls may be separate or integrated with master controls of an automated line. Self-contained construction simplifies relocation for job changeovers. Where central hydraulic systems are available, the units may be obtained without integral hydraulic pumps. The "Borizer" is available in four sizes with strokes of 8, 10, 12, or 15 inches and with thrust for multiple operations ranging from 9800 to 18,900 pounds.

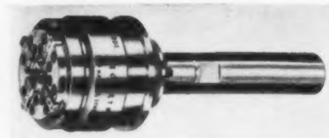
Circle Item 605 on postcard, page 197

## Geometric Self-Opening Die-Heads

Geometric "KDI" die-heads that can be easily converted from outside- to inside-trip operation by a few minor adjustments have been announced by Geometric-Horton, New Haven, Conn. The inside trip is desirable for use on those jobs requiring a thread of accurate length, as measured from the end of the work-piece. The manufacturer claims this feature makes it possible to cut accurate-length threads regardless of the chucking or location of the work-pieces, as the inside trip will always be actuated by the end of the work-piece.

On the larger sizes of these die-heads it is possible to attach reaming and chamfering tools to the end of the inside trip. As an example: Pipe or tubing can be reamed, chamfered, and threaded in one operation. The die-head can be closed by means of an operating yoke in the groove in the tripping flange. Provision can be made to pass the coolant through the shank of the die-head if desired.

Conversion to outside trip is made by a simple adjustment or by removing the inside trip completely. The Geometric "KDI" die-head can then be operated in exactly the same manner as the present line of "KD" die-heads.



Self-opening die-head announced by Geometric-Horton

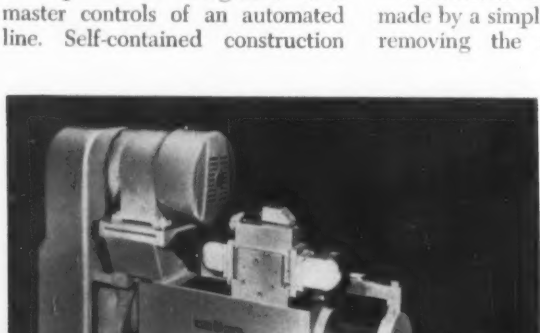
The Geometric "KDI" die-heads are available in seven sizes covering a range of 5/16 to 2 1/2 inches.

Circle Item 606 on postcard, page 197

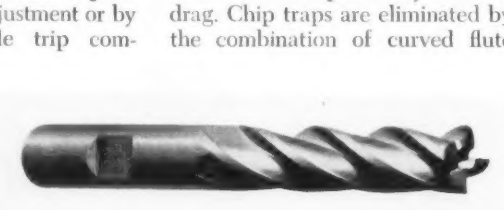
## End Mills Designed with "Flowing Curve" Fluting

End-milling cutters with design features considered theoretically ideal, but which were never before commercially attainable, are now being carried in stock by the branch offices of the Pratt & Whitney Co., Inc., West Hartford, Conn. These "G" type end mills are made with a generated flute shape in one continuous, flowing, curved surface from the cutting face of one tooth to the cutting face of the adjacent tooth, including the relief back of the adjacent tooth. They are ground from the solid on special, recently developed grinding machines.

An important feature of these end mills is the eccentric radial relief on the outside diameter, which eliminates the possibility of heel drag. Chip traps are eliminated by the combination of curved flute

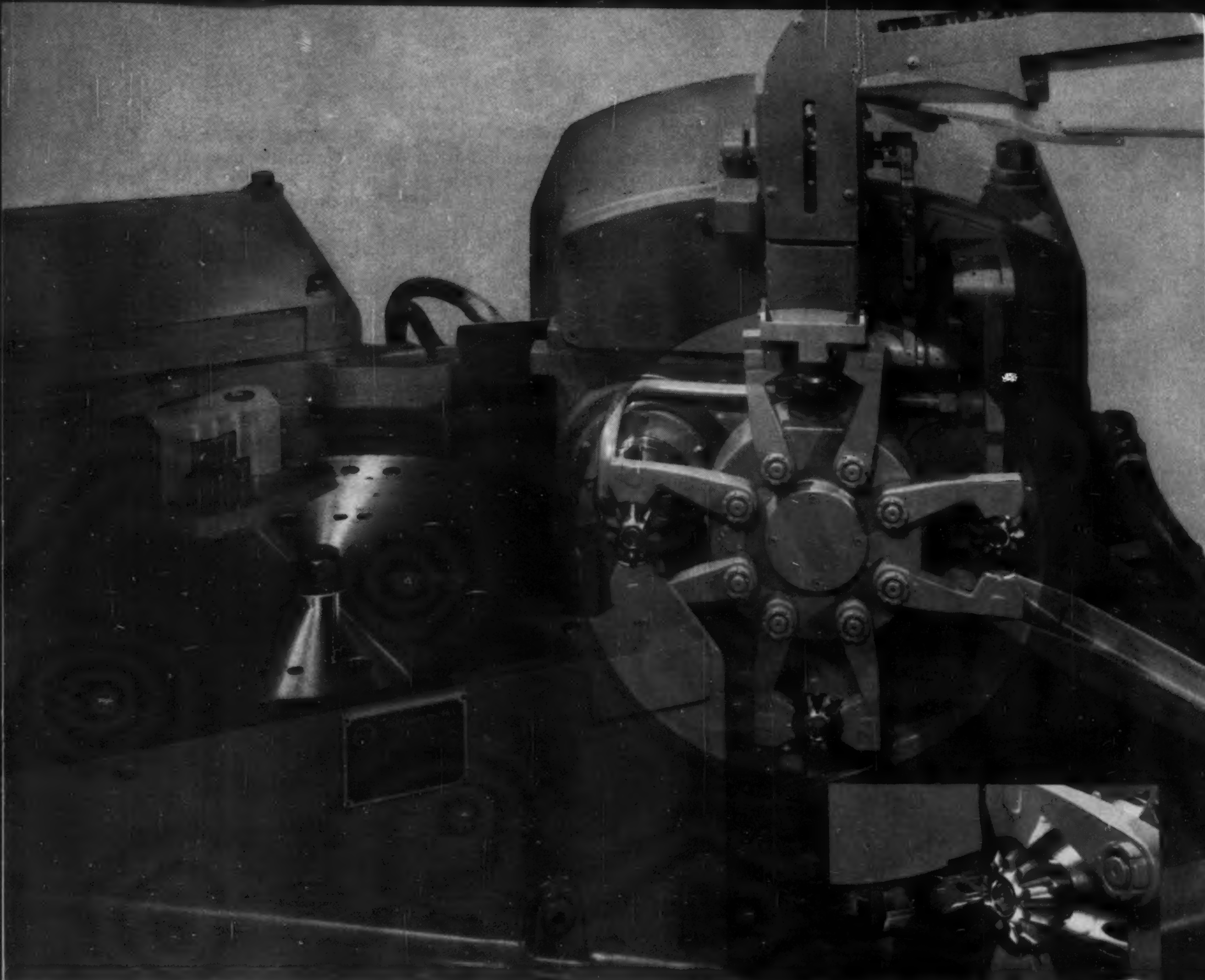






(Above) Pratt & Whitney end mills designed with "Flowing Curve" fluting

(Left) "Red Head" self-contained "Borizer" unit announced by the Heald Machine Co.



*In Revacycle Method each blade of cutter is longer than its predecessor; there is no depthwise feed of cutter itself. One rotation of the cutter completes each space from the solid.*

# Fastest way yet to cut straight bevel gears

If you're looking for a faster, fully automatic way to cut straight bevel gears and pinions with conjugate surfaces and localized tooth bearings, consider the Gleason No. 109 Straight Bevel Revacycle® Machine.

You rough, semifinish, and finish a tooth from the solid blank with a single rotation of the Revacycle cutter.

Now both 21″ and 25″ diameter cutters can be used on the No. 109 Revacycle Machine. The 25″ cutter cuts gears to a maximum depth of 0.600″. The 21″ cutter will cut to a maximum of 0.400″.

A new, completely automatic mechanism loads and unloads each gear. You can feed this loader manually or with a conventional belt conveyer.

The No. 109 Machine handles a wide range of automotive and farm machinery gears: up to 10″ diameter, 5:1 ratio, 1¼″ face width.

Send for our bulletin for information on both the machine and the Revacycle Method.

*Storage unit and flight conveyer can be fed manually or with belt conveyer. Even with manual operation, one operator can handle a battery of machines.*

**GLEASON WORKS**

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

shape and the highly polished surfaces of the flutes. These features, together with the end mill's uniform concentricity, greater accuracy of fluting index, and efficient heat-treatment, are said to result in exceptionally sharp, smooth-cutting edges, better finishes, and longer life per grind.

Four-tooth end mills from 1/8 to 1/2 inch in both single-end and double-end types are carried in stock, as are two-tooth mills in the single-end type from 1/4 to 3/8 inch, and double-end type from 1/8 to 3/8 inch.

Circle Item 607 on postcard, page 197

## B & S "Hite-Chek" for Transferring Dimensions

"Hite-Cheks" have been brought out by the Brown & Sharpe Mfg. Co., Providence, R. I., to eliminate chatter and other vibration in the transfer of dimensions set up by B & S "Hite-Icators," riser blocks, gage-blocks, etc. Coupled with Brown & Sharpe's "Magna-Set System," they are said to provide the lowest cost-per-inch of any height setting arrangement.

Utilizing a new lightweight, aluminum, tapered-box construction, the uprights provide rigidity and stability in supporting any dial test indicator, in any position. Sturdy bases with hardened and lapped graphitic-steel wear pads provide smooth, easy movement. Two-piece sliding heads permit quick, rough settings, while positive fine adjustments can be securely clamped. The units are particularly suitable for use with high-amplification indicators. Three standard sizes are available: 24, 36, and 48 inches high.

Circle Item 608 on postcard, page 197

## Delta Drill Press Equipped for Automatic Tapping

The Rockwell Mfg. Co., Pittsburgh, Pa., recently introduced a Delta 17-inch drill press equipped for automatic tapping. This machine has been especially developed to provide industry with low-cost automation. With only minor additions, a standard, single-spindle drill press is converted, at low cost, to an automatic tapping machine like the one illustrated.

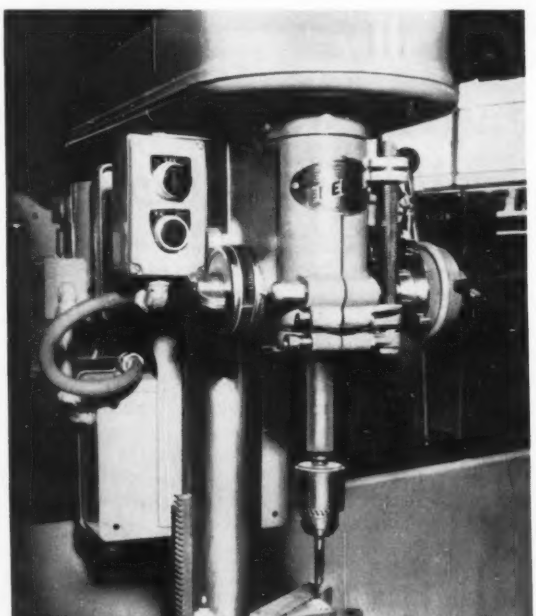
The "secret" of successful automatic tapping with the Delta drill-press setup shown is a reversing motor. The equipment also includes a control station consisting of a drill-off-tap selector switch and an emergency stop button; adjustable stops mounted on a ring held in place on the regular pinion shaft to actuate limit switches at the top and bottom of spindle travel; and a reversing magnetic starter. This setup automatically completes the tapping cycle.

The tap, with this setup, provides its own lead, and thus, practically no thrust is transferred from the machine to the tap. This provides a sensitive tapping action with no "shaving" of the threads—an advantage in tapping all materials, but especially advantageous when tapping lighter materials such as aluminum, magnesium, or plastics.

Other advantages of the automatic tapping setup include the provision for switching from drilling to tapping by merely throwing the selector switch on the control station; use of a reversing motor that provides greater capacity for a given horsepower than when tapping attachments are used; and the lower cost of the reversing motor setup.

Circle Item 609 on postcard, page 197

"Hite-Chek" brought out by Brown & Sharpe Mfg. Co. for transferring dimensions

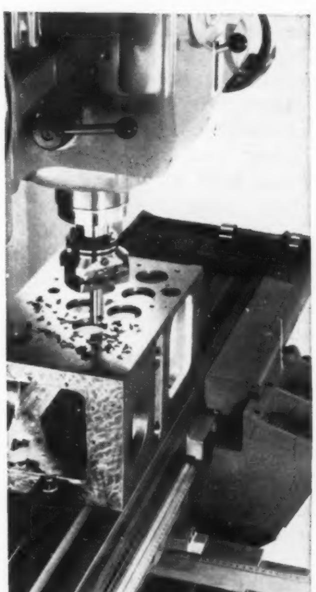


Delta drill press equipped for automatic tapping announced by Rockwell Mfg. Co.

**Boring operation on 24" aluminum microwave component.** Note complicated set-up made simple with HURTH tiltable worktable. Deep throat of machine saves set-up time . . . saves cutters, too.


PHOTOGRAPHED AT L. H. TERPENING CO.

# can you match these savings... in your boring and milling operations?



**Close tolerance boring in gear box housing. Note optical reading devices at right.**

**65% saving in set-up and production time at RAYTHEON**

*"The HURTH V10a performs both jig boring and milling operations that would cost us three times as much on other type equipment. We find it flexible for short runs and equally reliable and consistent for long runs."*

says Albert Waldstein, Mgr., Machine Design and Fabrication, RAYTHEON MANUFACTURING CO.

**25-50% saving in toolroom and small lot production at TERPENING**

*"The HURTH V10a cut our jig boring and milling time up to 50% compared to equipment formerly used. It's the first machine we turn to for close-limit tooling and small lot production and it does work not possible on our other machines. In jig boring with the HURTH, we locate and size holes within .0002"."*

says E. J. Friebele, Chief Engineer, L. H. TERPENING CO.

---

Both agree—as do all other HURTH users—that there's no precision tool so economical to run when complicated set-ups with many tool changes are required. For the HURTH combines vertical milling, downfeed milling and jig boring in one machine—performs these *three different operations* to close tolerances with *one* set-up of the work. Large optical reading devices facilitate quick, accurate coordinate settings. You merely change table settings and cutting tools for:

VERTICAL MILLING—using longitudinal traverse of worktable, which can be tilted 15° to front or rear.

DOWNFEED MILLING—using longitudinal traverse of worktable and graduated downfeed of cutting spindle.

JIG BORING—using continuous spindle downfeed, varied in extremely small steps.

Match the savings other HURTH users are getting—in your toolroom—on your production line. Talk it over with one of our sales engineers. Write for details.

KO CO., INC. PRECISION MACHINERY

# KURT ORBAN
## COMPANY, INC.

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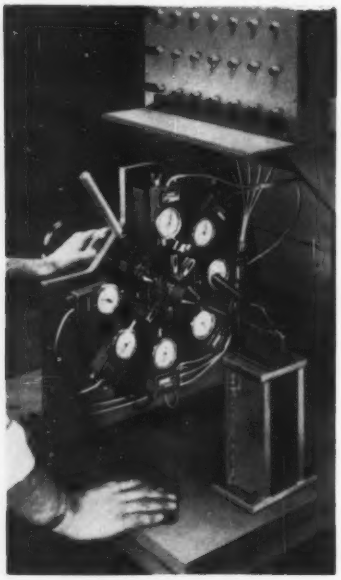


Fig. 1. Federal semi-automatic gage for checking cams

## Gage for Checking Stack of Seven Cams Simultaneously

Groups of seven different cams, arranged in stacks, are checked for contour, proper stacking, and for broken or chipped edges on a semi-automatic electric gage, Fig. 1, made by Federal Products Corporation, Providence, R. I. As shown in View A, Fig. 2, a master cam stack is permanently fixed on a precision locating shaft. The stack to be checked is positioned precisely on the same shaft and held tightly in place by a pressure plate. Reference contacts ride the contour of each of the seven cams in the master stack. The sensitive gaging contacts which check the work-pieces are coupled to the reference contacts by means of pantographs and follow them exactly as the shaft is rotated. The inspector rotates the handwheel (see Fig. 1) one full turn to check the leading edge of the cams. He then checks the trailing edges.

Electrified dial-indicator gaging units, called "Electricators," contact the pantographs, and any difference between a reference contact and its sensitive counterpart causes the Electricator spindle to move. The spindles actuate switching contacts shown in View B, Fig. 2, which control signal lights. By glancing at the bank of lights mounted above the gaging station, the inspector can quickly ascertain the acceptability of the entire stack of cams.

**Circle Item 610 on postcard, page 197**

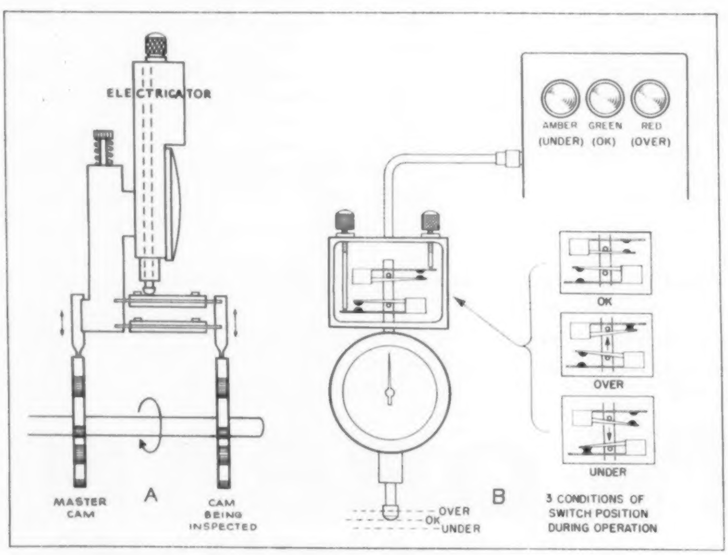
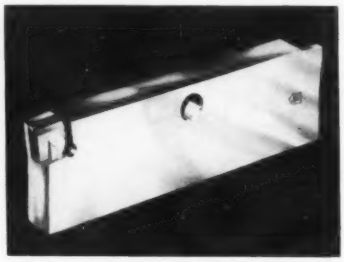



Fig. 2. Diagrams illustrating operation of gage shown in Fig. 1

## Davis Throw-Away Insert Cutter Blocks

The advantages of throw-away carbide tooling have been made available in block type boring tools brought out by the Davis Boring Tool Division, Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. These cutter blocks are designed to use precision-ground, square, carbide tips. The square tips eliminate carbide grinding, provide for instant tip indexing, lower the cost per cutting edge, and reduce tool inventory.

Designed for use in standard Davis boring bars, the new blocks are available in two-cutter, as well as single-cutter, micrometer-adjustable styles. The two-cutter blocks for rough boring, and the micrometer-adjustable blocks for semifinish or finish-boring, are available with positive or negative rake, in Series G8, G6, and G4, covering a bore range of 2 1/2 through 17 inches. All blocks are hardened.



Davis throw-away insert cutter block

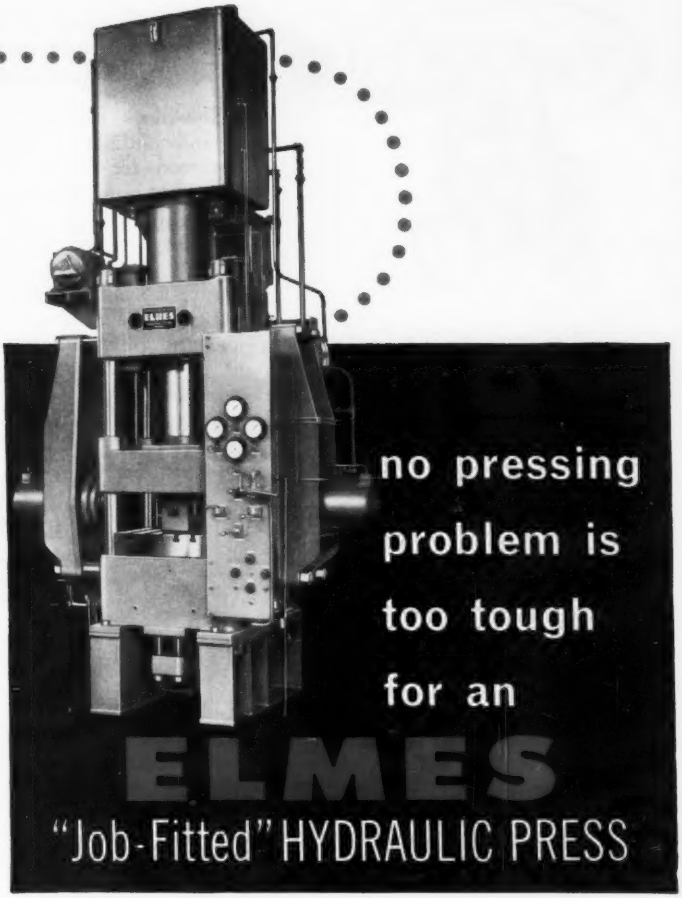
The insert and carbide chip-breaker are held in place by a screw type clamp. When the clamp is loosened, it travels forward, over the chip-breaker, partially ejecting the insert to enable easy indexing or replacement. Two-cutter blocks, with their opposed cutter design, prevent out-of-round boring. Diameter tolerances can be held to 0.004 inch. Micrometer-adjustable single-cutter blocks employ a micrometer-adjusting screw which positions the block in the bar slot, permitting boring to tolerances of 0.001 inch.

The blocks slip into the bar without disassembling, and are secured in the bar slot by a single tapered locating screw. As this screw is tightened, the tapered section centers the block with the bar, drawing the block firmly into position against two bearing surfaces in the bar slot.

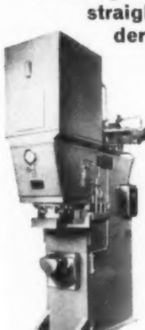
**Circle Item 611 on postcard, page 197**

*(This section continued on page 214)*

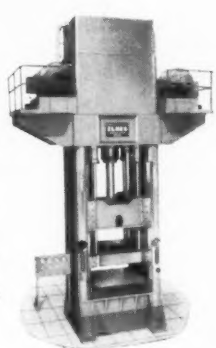
**Because of what this unique DEVELOPMENT PRESS tells us...**



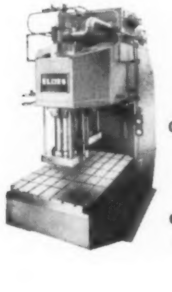

**Elmes Presses are built in standard and special designs for metal drawing and forming, bending, straightening, forcing, powdered metal compacting, hobbing, etc.**



HORNING PRESSES — for coining and truing wheel rims and similar items. Built in a wide range of sizes and capacities.



DOUBLE-ACTION DRAWING AND FORMING PRESS with 300-ton main slide and 100-ton blankholder slide. (Total tonnage is available for single action.) Single and Triple-Action types also available.



SPECIAL 600-TON C-FRAME PRESS — an adaptation of a standard C-Frame design. Combines two 300-ton presses in one. The unit can be operated with both cylinders in unison, or as individual presses.

The ingenious try-out press shown above is an exclusive creation of Elmes engineering. Center of activity in the Elmes Research Department, this versatile unit, with *four rams*, can be set up on *almost any operation that a hydraulic press is normally called upon to perform.*

Thus, a customer's out-of-the-ordinary metal pressing work can be tried out, and specifications for a production press of maximum efficiency accurately determined—not just on paper, but after having been *performance-proved under actual working conditions.*

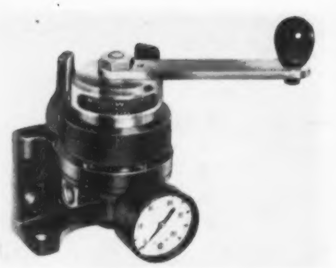
Research with this press also permits the engineering of greater unusual-job adaptability into standard Elmes® Presses. As a result, where a standard Elmes Press does not fully meet a customer's requirements, it can be readily, efficiently, and economically modified in design.

Send us *your* pressing problem—you'll find that Elmes facilities can save time and money on your development work. See your Elmes Distributor, or write direct.

**Elmes** American Steel Foundries ENGINEERING DIVISION

1162 Tennessee Avenue, Cincinnati 29, Ohio

METAL-WORKING PRESSES • PLASTICS MOLDING PRESSES • PUMPS • ACCUMULATORS



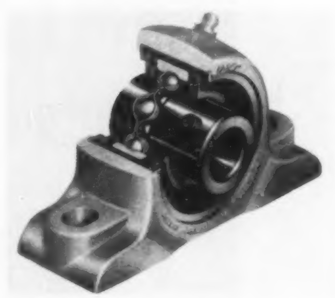
## Differential Air Control for Chucks

New model differential air control brought out by the N. A. Woodworth Co., Detroit, Mich., for use in conjunction with this company's diaphragm chucks and air-operated "Tork-Lok" arbors. It is designed to increase or decrease clamping pressure during the machining cycle to control distortion. Two pressures are used: one to operate the air device; the other, to regulate the air released for clamping the part. The difference between the two pressures is the true pressure applied to the work.

Circle Item 612 on postcard, page 197

## Hoover Sound-Conditioned Pillow-Block Bearing

Pillow-block ball bearing that is "sound-conditioned" and expressly designed for applications where extremely quiet operation is essential. This bearing, recently introduced by the Hoover Ball & Bearing Co., Ann Arbor, Mich., incorporates a synthetic rubber cushion between the bearing's outer ring and the pillow-block housing to



insulate against vibration and suppress noise. The units are made in five shaft sizes—1/2 through 1 inch.

Circle Item 613 on postcard, page 197

## Walker Plate Type Demagnetizer

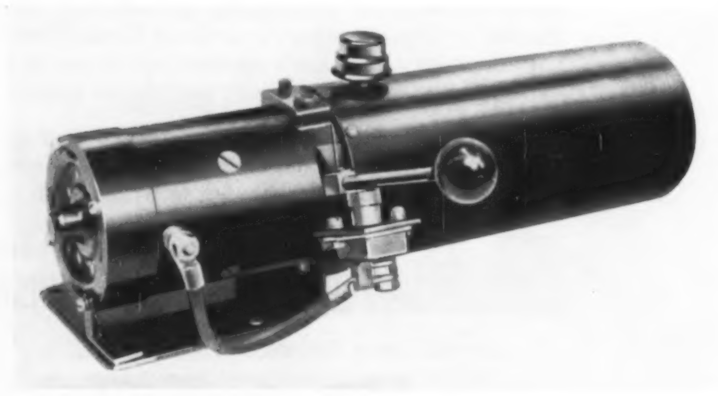
Plate type demagnetizer designed to provide low-cost demagnetization of ferrous parts announced by O. S. Walker Co., Inc., Worcester, Mass. This new high-powered unit features deep penetration and may be operated on a 25-per cent-duty cycle. The demagnetizer is ideally suited to toolroom use for demagnetizing cutters, drills, gears, and similar parts, as well as for small production runs. The top plate is 7 by 9 inches. The unit operates on 220 volts, 6-cycle alternating current, and draws 15 amperes.

Circle Item 615 on postcard, page 197

## Barnes Hydraulic Power Unit

Fluid-power unit designed to provide dependable service for operating tractors, dock-leveling devices, tail-gate lifts, dump bodies, snow plows, cement mixers, lift trucks, and other kinds of equipment. This compact and rugged unit is operated by a rotary gear pump with capacities ranging from 1/2 to 4 gallons per minute at 1800 rpm and increased delivery at 3600 rpm at pressures up to 2000 psi. Reservoirs are regularly available in 1 1/4-, 2 1/8-, or 3-quart capacities. Reservoirs for larger volumes can also be furnished. Direct, belt, or special drives are available. Ball-bearing continuous or intermittent motors of 1/4 through 2 hp of alternating-current design in standard, special, and explosion-proof types are available. Motors for operation on 6, 12, or 24 volts can be provided. Made by John S. Barnes Corporation, Rockford, Ill.

Circle Item 614 on postcard, page 197



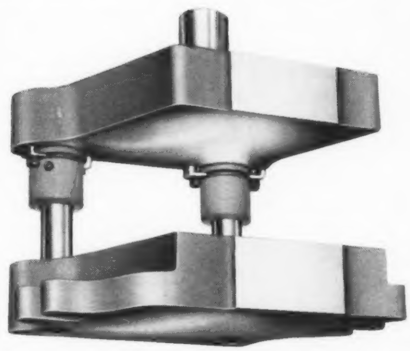
## "Turbo-Cut" Tap

Threadwell "Turbo-Cut" tap developed by the Threadwell Tap & Die Co., Greenfield, Mass., to provide optimum chip removal without sacrifice of accuracy and to reduce tap breakage to the absolute minimum. This is achieved by making the tap with a relatively high spiral flute. During the tapping operation, chips are moved away from the cutting edges of the tap at a much greater angle than

# There's Always Something New at DANLY®

**in**

## DIE SETS

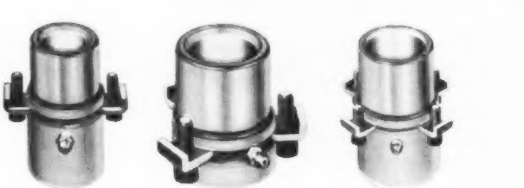


*New Danly Demountable Die Sets* offer you uniformity in a precision fit never before achieved in die sets. Danly Demountable Bushings seat with a tap fit, flush against the ground face of the punch holder with the bore perpendicular to that surface. They are *pre-fitted* in manufacturing so accurately that they are interchangeable. You get 100% bearing every time.

Bushings are easily removed for die work or grinding and returned to proper fit, always. Products of Danly's 36 years' experience, Danly Demountable Bushing Die Sets are stocked near you, giving you fast delivery from a local source.

**in**

## BUSHINGS



*The New Danly Bronze Plated Demountable Bushings* are recommended for use on all Die Set applications requiring high surface speeds, especially with side thrust loads. They are manufactured to the same degree of precision fit as hardened steel and bronze bushings. Factory pre-setting is extremely accurate and reliable . . . lets bushings and guide posts work interchangeably. Available in both shoulder and short shoulder design . . . also in shoulder guide post bushings.

**in**

## DIE STOPS

*New 5/16" Die Stop* completes a full Danly line. Economical, the stop is priced at a fraction of the cost of handmade versions. For easy-to-install, easy-to-use Die Stops, specify the "Big Four" of Danly. They're adaptable to all Dies. Other sizes include 3/16", ¼", and ⅜" bars, with arm extensions from 3" to 6".

**in**

## TOGGLES

*New easy-grip Kwik-Klamp Toggle Clamp* features plastic handle for more comfort and convenience. New fork bar is more versatile, stronger. The new clamps are available with either straight or flanged bases, and with swivel or universal adapters. It is the only toggle clamp available which can be adjusted to any compound clamping angle.

*Look to Danly, the leading supplier in the stamping industry, for progress—for all that is new and modern in Die Sets and Die Makers' supplies. Send for information on Dowel Pins, Socket Screws, Bushings and Guide Posts, Roller Stock Guides, etc. Or simply contact your nearest Danly branch or distributor.*

**For more data, circle this page number on inquiry card**

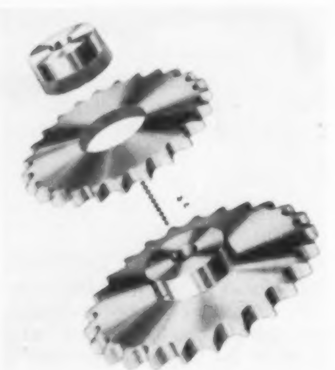
**DANLY MACHINE SPECIALTIES, INC.**
**2100 S. Laramie Avenue, Chicago 50, Illinois**

DANLY®

*The leading supplier to the stamping industry*
Die Sets • Die Makers' Supplies • Mechanical Presses

is the case with a standard, spiral-fluted tap. The chips are then forced upward in a fast spiral with greater thrust from the flutes. Reduced to the most simple form, the chips are moved upward in faster and easier stages with continuous thrust from the sides of the flutes. On reaching the surface of the work-piece they are propelled out of the hole away from the tap. Field tests have shown that the Threadwell "Turbo-Cut" taps give outstanding performance in tapping ductile materials. They have also been used with excellent results in tapping stainless steel as well as plastics.

Circle Item 616 on postcard, page 197



## "Selecta-Bore" Sprockets

Unique and ingenious finished-bore stock sprocket assembly called "Selecta-Bore" developed by the Whitney Chain Co., Hartford, Conn., to provide more rapid off-the-shelf service to roller-chain sprocket users. The sprockets in this line provide a complete assortment of over six hundred possible pitch, tooth, and bore size combinations.

Circle Item 617 on postcard, page 197

## Push-Button and Pilot Light

Push-button combined with a pilot light in one unit announced by the Allen-Bradley Co., Milwaukee, Wis. This Bulletin 800T illuminated, heavy-duty push-button unit is completely sealed to exclude oil and coolants, and the contact block has double-break NO-NC contacts of silver alloy that practically never require maintenance. A step-down transformer is built into each unit to supply the more rugged 6-volt pilot lamps. The unit is designed to fit the manufacturer's standard oiltight enclosures, and can also be installed in existing oiltight control stations. Button type lenses can be furnished in a variety of colors, and guard collars are available to

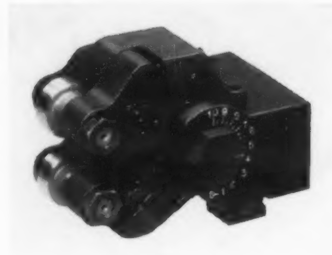

protect the button. The guards can also be used with a padlock to lock the button in the "down" position.

Circle Item 618 on postcard, page 197

## Sundstrand Hydraulic Pump for Lubricating Oils

One of a line of Q7 series gear type hydraulic pumps designed to handle lubricating or hydraulic oils at pressures from 20 to 300 psi and speeds of 1200 to 1800 rpm, announced by the Sundstrand Hydraulic Division, Sundstrand Machine Tool Co., Rockford, Ill. Four capacities of pumps are available for either left- or right-hand shaft rotation. The capacity of the pumps in the Q7 series ranges from 38 to 41 gallons per hour at 1200 rpm, and from 57 to 62 gallons per hour at 1800 rpm. The pumps are supplied with positive-acting, piston type relief valve in any of these four pressure ranges: 20 to 40, 40 to 80, 80 to 150, and 150 to 300 psi.

Circle Item 619 on postcard, page 197



## Reed Thread-Rolling Attachment

The Reed Rolled Thread Die Co., Holden, Mass., has just announced this small-sized Model B5 thread-rolling attachment designed for use on the No. 00 Brown & Sharpe single-spindle automatic on which the larger size Reed Series B attachments are not applicable. The new attachment has a diameter capacity of from 0 to 5/16 inch and a maximum thread-length capacity of 1/2 inch. This two-roll attachment is adjustable, self-compensating, and similar to other Reed Series B attachments. It is designed to produce precision threads. Rolls of the same diameter can be used interchangeably.

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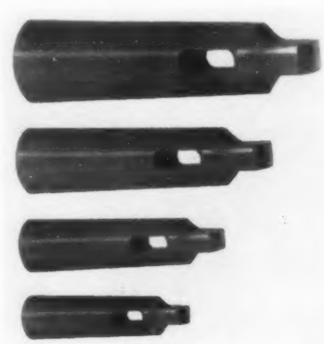
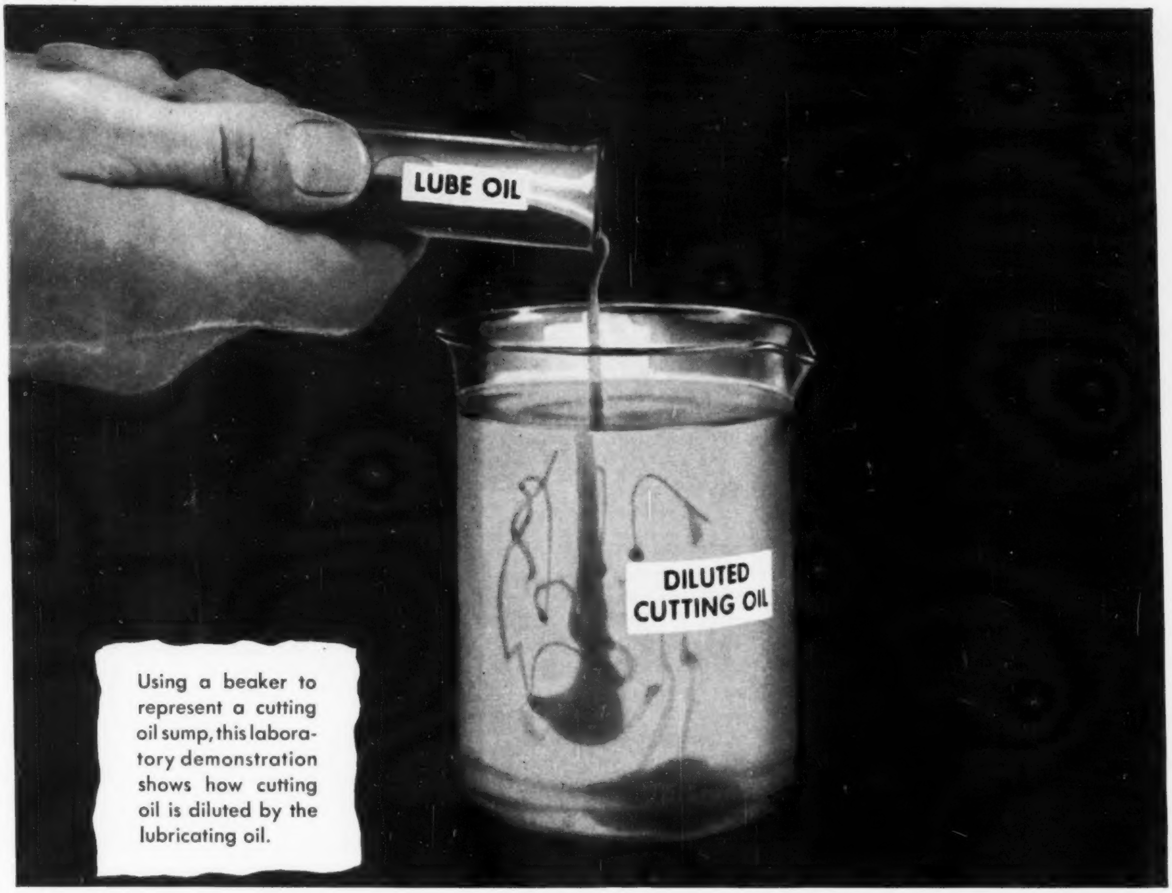


## James Nylon Drill Sleeve

Drill sleeves made of virgin du Pont nylon brought out by the James Products Co., Mentor, Ohio. This drill sleeve is designed to eliminate drill breakage and to protect spindles and quills from damage. The sleeve, not the drill, will break when the drill hits a hard spot or air hole and stops. The sleeves are guaranteed to meet or exceed accepted drill-sleeve standards of accuracy. Produced in Morse taper sizes 1-2, 2-3, 3-4, and 4-5.

Circle Item 621 on postcard, page 197



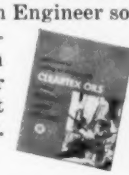

# Diluted cutting oil can cut output 33%

No matter how careful your lubricating techniques, you still can't stop lube oil from leaking into the cutting oil sump on 70% of automatic screw machines. As cutting oil is diluted, it loses strength—ingredients that make it efficient become less and less effective. The natural consequence is shortened tool life, more downtime and a higher percentage of rejects.

**Texaco Cleartex can end this problem forever.** All you have to do is use Cleartex for both cutting *and* lubrication . . . and watch your production rise. The exceptional chemical stability and load-carrying ability of the Cleartex series make them equally suitable for use as cutting oils, lubricants and hydraulic fluids. (70% of all automatic screw machines can benefit from the "Cleartex Cure!")

**TAKE THE CLEARTEX CURE SOON!**

Write today for your copy of Texaco's new booklet—"Cleartex in Automatic Screw Machines." This new illustrated guide will fill you in on the details, show you where you may be losing profits and how to avoid it . . . Or contact your local Texaco Lubrication Engineer soon for an authoritative survey of your automatics. Just call the nearest of more than 2,000 Texaco Distributing Plants, or write to The Texas Company, 135 East 42nd Street, New York 17, New York. Dept. MA-11.



TEXACO

IN ALL STATES

LUBRICATION IS A MAJOR FACTOR IN COST CONTROL

(PARTS, INVENTORY, PRODUCTION, DOWNTIME, MAINTENANCE)

By E. S. Salichs

# BETWEEN GRINDS

## A Mariner's Must

Michael D. Oswalt, in the Repair Division on the U.S.S. Albemarle, wrote to MACHINERY recently: "In your September, 1958, issue, there was a data sheet on thread dimensions. It was just the thing we had been needing for our shops as a quick reference form. Of course they had to be a lot larger so I took the page down to our ship's printer. Naturally before he even got a copy made, the sheet was misplaced! Now my question is: Can I obtain another in any way?" Naturally, we forwarded *two* copies of the aforementioned data sheet immediately.

## The Beat of the Beam

A mechanical light chopper developed by Westinghouse scientists emits a staccato of precise, ultra-fast light pulses for testing how fast electronic devices react to light and other radiations, according to *Industrial Research Newsletter*. The chopper will be used to shred, we mean shed, light in such fields as TV, high-speed photography, and fluorescent illumination.

## Swab on Job

The cotton-tipped swab has been lent by the nursery to the factory, we are told. Q-tips, originally designed for nursery use, are being used to clean center holes prior to mounting for machining, and for cleaning bottoming holes before gaging, as well as for applying flux in delicate soldering operations.

## Sailboat Safari

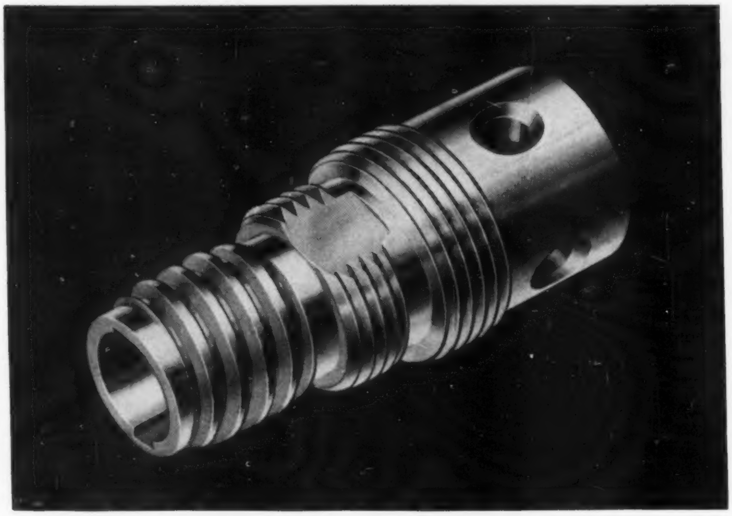
A solar "sailboat" that can take man to Mars and beyond (that "beyond" has us worried) was recently demonstrated at the Westinghouse Research Laboratories. The principle behind the solar ship was first observed 85 years ago: that when the sun shines on a body it also exerts a pressure—in this instance on a space boat which would be launched from the earth by a 1-ton rocket. Once in orbit, the rocket would be discarded, and a huge, parachute-shaped sail unfurled and attached by shroud lines to a gondola carrying a 1000-pound payload and crew. No week-end jaunt, however, since breaking away from the earth's gravity might take several weeks. Then there is an estimated 118-day orbit-to-orbit travel time to Mars, and what with sightseeing, shopping, and hitting the high spots, you would probably need extra vacation time. We're too busy, honestly.

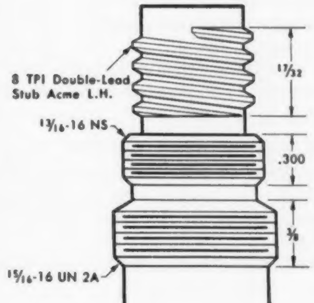
## Vendor of Distinction Prefers Stainless

The old wooden hot dog pushcart, painted red and streaked with mustard, is being replaced by gleaming stainless-steel wagons, according to *Steel Facts*. One reason for their popularity is that stainless steel helps to retain heat and cold, requisites for hot hot dogs and cold cold pop. And how many times in the past have you bought vice versa?

HAVE HARDWARE, WILL TRAVEL—The three trailers seen here, pulled by a tractor, constitute a "hardware train" which supplies 5300 different kinds of nuts, bolts, screws, washers, rivets, and gaskets used to manufacture F8U Crusaders and Regulus guided missiles at Chance Vought Aircraft, Inc., Dallas, Tex. Six trains work continuously to keep the plant supplied, and their use has cut down tremendously the paper work and running around required to draw such items out of general stores.

# COST CUTTING on tough jobs—like rolling a double-lead Stub Acme thread—may be easier than you think. Olson Mfg. Co. needed only a minor adjustment in a standard Anaconda rod

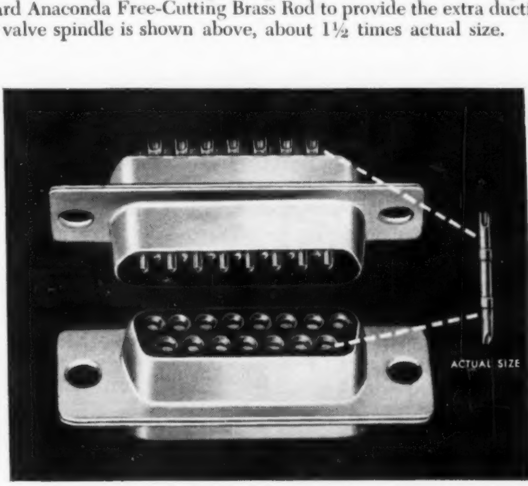


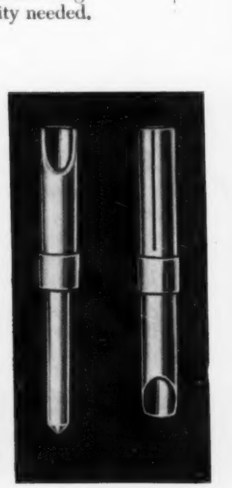



Rolling three threads *(drawing, right)* in two positions on a 6-spindle automatic meant cost savings for Olson Mfg. Co., Worcester, Mass. The Acme thread, however, posed problems. American Brass specialists suggested minor modification of standard Anaconda Free-Cutting Brass Rod to provide the extra ductility needed. The idea worked and the resulting valve spindle is shown above, about 1½ times actual size.

**—or maybe you need a different alloy rod.** The tiny connectors, right, have to be machined from .078″ rod, requiring many precision form-cutting, drilling, slotting operations. So machinability is a vital property of the rod used—but so are adequate electrical conductivity, high strength, and fatigue resistance.

Cannon Electric, Los Angeles, makers of these electrical plug assemblies, had to find a rod with a delicately balanced combination of mechanical properties to provide the unfailing and continuous performance required. They found it in Anaconda Free-Cutting Phosphor Bronze-610 Rod, developed by American Brass metallurgists to combine the strength, resilience, fatigue resistance of phosphor bronze, and machinability approaching that of free-cutting brass.



MEETING the joint requirements of designers, manufacturing men, and buyers—to achieve high quality and performance while simplifying fabrication and cutting over-all costs—is an important function of American Brass technical specialists. For imaginative and practical help of this kind, see your American Brass Company representative or write: The American Brass Company, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont. 5938

ANACONDA®

**COPPER · BRASS · BRONZE**
**NICKEL SILVER · MILL PRODUCTS**

*Made by The American Brass Company*

# News OF THE INDUSTRY

## California and Texas

LOCKHEED MISSILES SYSTEMS DIVISION, Sunnyvale, Calif., has formally changed its name to LOCKHEED MISSILES AND SPACE DIVISION, it was announced by L. EUGENE ROOT, Lockheed Aircraft Corporation vice-president and general manager of the division.

NORTHROP AIRCRAFT, INC., Beverly Hills, Calif., has announced a change in its name to NORTHROP CORPORATION. At the same time, the company's Northrop Division at Hawthorne, Calif., will take the name of NORAIR.

LLOYD COWDIN has been appointed by Mead Specialties Co., Chicago, Ill., as its representative for northern California. His headquarters are at 1606 E. 14th St., Oakland.

R. G. (DICK) MAUS has been appointed Western Division sales manager for CLECO AIR TOOLS, a division of Reed Roller Bit Co., Houston, Tex.

(Left) H. L. Cogswell, vice-president, sales and service activities, Machine Tool, Coolant Cleaning Equipment, and Honing Divisions, and (right) Roger Marriott, newly elected secretary and treasurer, Barnes Drill Co.

## Illinois, Wisconsin, and Missouri

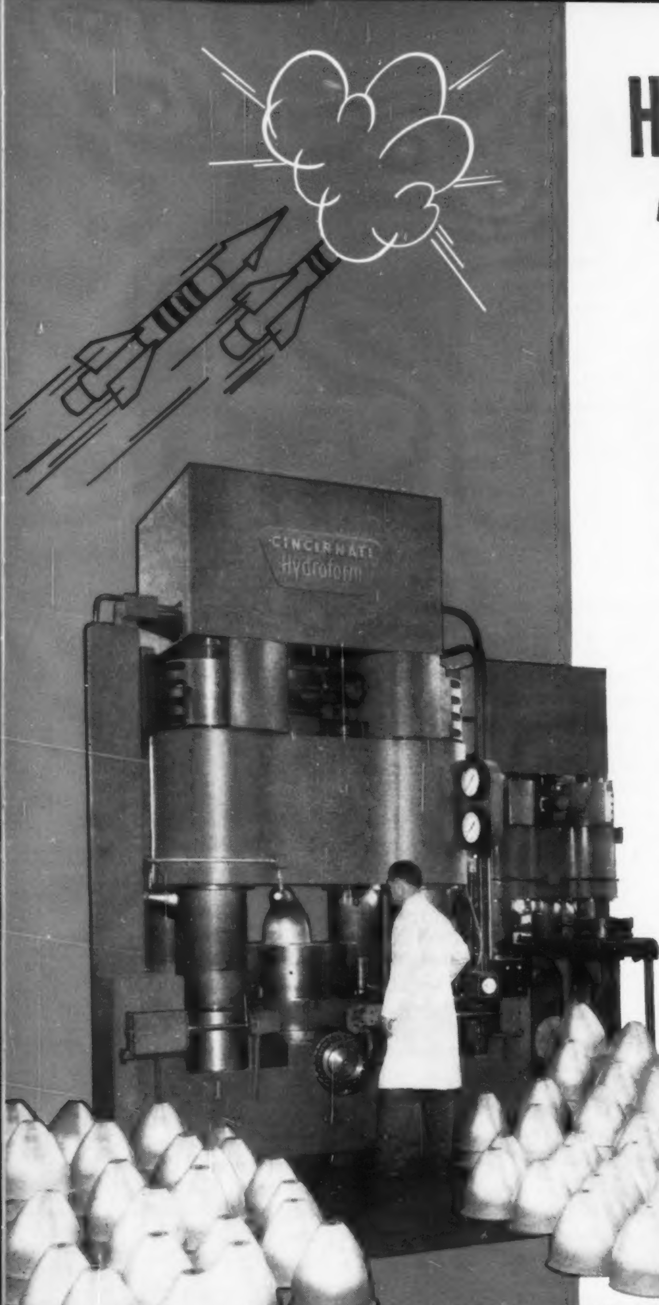
CLEARING, division of U.S. Industries, Inc., Chicago, Ill., announces the appointment of PRODUCTION EQUIPMENT CO. to be its local dealer in central and eastern Michigan. The division also announces the appointment of INTERNATIONAL MACHINERY CO., Ltd., to be its dealer in Canada for the full line of Clearing products. IOWA MACHINERY & SUPPLY CO., Des Moines, Iowa, will be its local dealer in Iowa for Clearing's open-back inclinable and horning presses up to 200 tons capacity. Clearing has appointed L. L. RICHARDS & CO., Milwaukee, Wis., to be its local dealer in Wisconsin for mechanical presses up to 200 tons capacity.

BARNES DRILL CO., Rockford, Ill., announces the following changes in officer responsibilities: H. L. COGSWELL has been elected vice-president in charge of sales and service activities of the company's Machine Tool, Coolant Cleaning Equipment, and Honing Divisions. ROGER MARRIOTT, executive vice-president of Barnes Drill Co., has been elected secretary and treasurer. HAROLD A. JOHNSON has been elected vice-president in charge of engineering and manufacturing. ALFRED G. BLOCK, vice-president and secretary-treasurer of Barnes Drill Co., Rockford, Ill., has retired February 1 after nearly forty years of service with the company.

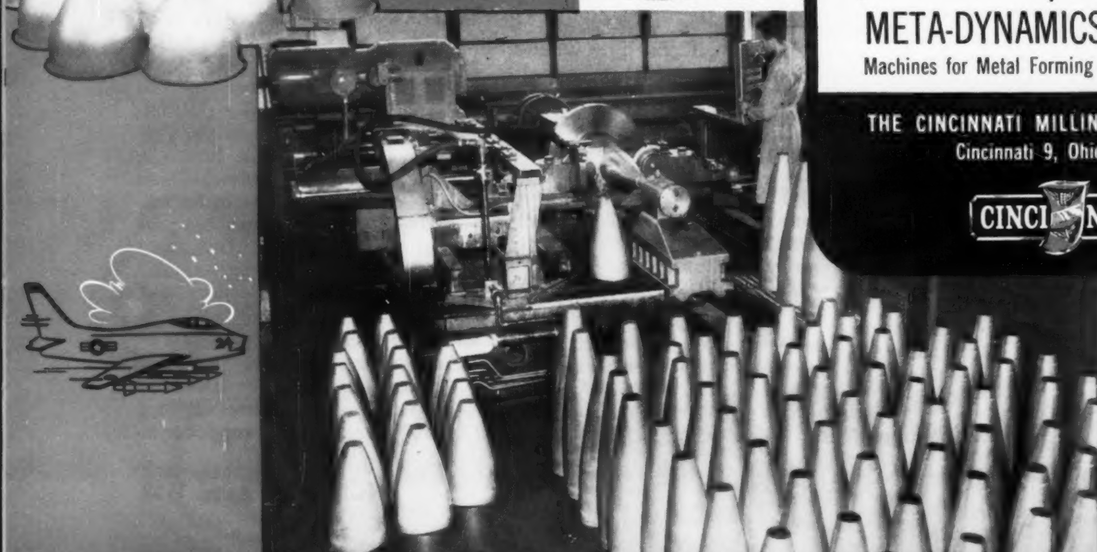
UNIMET CARBIDES, division of United-Greenfield Corporation, Chicago, Ill., has recently appointed the following stocking distributors: BADGER MILL SUPPLY CO., 1918 Algoma Bldg., Oshkosh, Wis.; CASANAVE SUPPLY CO., INC., 2028 Sansom St., Philadelphia, Pa.; KENNETH L. EKDOHL, 2520–30th Ave. Court, Moline, Ill.; and BRUCE INDUSTRIAL SUPPLY, 4049 New Castle Ave., Wilmington, Del.

JOSEPH T. RYERSON & SON, INC., Chicago, Ill., announces the following management changes. MELVIN B. MONSON, general manager of the Milwaukee plant, has been named general manger of the plant at Los Angeles. He succeeds WAYNE D. DUKETTE, deceased. New general manager at Milwaukee is CHARLES S. HEGEL, who was national product manager for stainless steel. H. DANIEL ROBB, national product manager for alloy steel, has replaced Mr. Hegel. EDWARD J. RICHARDSON, in addition to his duties as national product manager for tubing and cold finished bars, will assume Mr. Robb's former responsibility for alloy steel.

AMERICAN STEEL FOUNDRIES, Chicago, Ill., announces that CHARLES C. JARCHOW, who has been president since 1949, was elected chairman of the board. He is succeeded as president and chief executive officer by JOSEPH B. LANTERMAN, vice-president since 1954. CHESTER E. GRIGSBY, vice-president since 1949 and general manager of the Transportation Equipment Division since 1957, was elected a director succeeding THOMAS DREVER, who retired from the board. GEORGE S. ALLEN, vice-president of the Harris Trust & Savings Bank, was elected a director for the unexpired term of the late GUY E. REED. RALPH D. BRIZZOLARA and CHARLES L. HEATER, vice-presidents of American Steel Foundries, and FRANK W. JENKS, president of INTERNATIONAL HARVESTER CO., were re-elected directors.







The Chicago branch of VICKERS INCORPORATED—division of Sperry Rand Corporation—has moved to a new building with increased facilities. Announcement was made by E. O. CLARK, branch manager. The new structure is at 350 N. York Road, Bensenville, Ill., west of the O'Hare Airport.

WARREN G. CUDLIP is new manager of quantity sales at CUTLER-HAMMER INC., Milwaukee, Wis.

MARION L. RENSINK has been named sales engineer for the St. Louis district of the Sinclair Refining Co., New York City, a subsidiary of Sinclair Oil Corporation. The district covers the eastern two-thirds of the state of Missouri.

## Michigan

WESSON CO., Detroit, Mich., has promoted four district supervisors to district manager and has appointed three new sales and service engineers. Advanced to district managers in their respective areas are: SY DWORECKI, Chicago; JAMES J. SMITH, JR., East Paterson, N. J.; GERALD BOGNER, Cleveland; and ANTHONY ROGERS, Detroit. New sales and service engineers are JOHN TAYLOR for southeast Michigan; ROBERT L. WILSON for the Dayton-Columbus, Ohio, area; and WILLIAM GERMANI for selected accounts in the Detroit area.

METALLURGICAL PRODUCTS DEPARTMENT, General Electric Co., Detroit, Mich., announces that DR. CHARLES E. REED has been named general manager. He succeeds KENNETH R. BEARDSLEE, who had been general manager since 1951. Mr. Beardslee becomes a consultant for the department. Dr. Reed coauthored the book "Applied Mathematics in Chemical Engineering." The department also announces the promotion of H. J. SIEKMANN to manager, market development and research.

COMPOSITE FORGINGS, INC., of Detroit, Mich., announces the election of MRS. C. M. GUSE as president, and LOUIS P. MILLER as secretary-treasurer. Other changes include the appointment of D. W. MILLS as sales manager, W. WECH as manager of the Forge Plant, and HENRY JESSOP as manager of the Special Machine and Fabrication Division.

HOWARD CARSON was elected vice-president of CADILLAC GAGE CO., Detroit, Mich., and general manager of the Costa Mesa operation. Cadillac Gage is an Ex-Cell-O Corporation subsidiary.

WILLIAM JAYNES has been made product manager of bearing bronzes for MEIER BRASS & ALUMINUM CO., Detroit, Mich.

SIDNEY E. BEACH has been appointed Michigan district sales manager of the RADIAL DRILL MFG. DIVISION, Veet Industries, East Detroit, Mich.

## New England

NORTON CO., Worcester, Mass., announces the following personnel changes: RALPH M. JOHNSON, vice-president of NORTON CO., has retired as director of sales. He was re-elected a director and vice-president, and will be retained as a consultant for one year. Mr. Johnson also retired as a director of BEHR-MANNING CO., a Norton division located in Troy, N.Y. GEORGE N. JEPPSON was re-elected chairman of the board and MILTON P. HIGGINS was re-elected president of Norton Co. WILLIAM H. PERKS, Norton treasurer and controller, was appointed a director of Behr-Manning Co. to succeed Mr. Johnson. LESTER A. HANSEN, Behr-Manning technical director, Coated Abrasive Technical Department, was also appointed a Behr-Manning director to fill the vacancy caused by the retirement of JOHN O. AMSTUZ, Behr-Manning's former vice-president in charge of engineering.

BAY STATE TAP & DIE CO., Mansfield, Mass., became a subsidiary of CLEVELAND TWIST DRILL CO., Cleveland, Ohio, in March. Operations of Bay State will continue in Mansfield. LOUIS A. LINCOLN, who has served as president for the past twenty-two years, will continue in that capacity.

LELAND-GIFFORD CO., Worcester, Mass., announces that it has elected WILLIAM F. LELAND chairman of its board of directors. STANLEY B. DOWD becomes president in his place. A. L. WILKINSON, who has been elected treasurer, is executive vice-president as well.

GLEN H. STIMSON has been appointed chief engineer of the GREENFIELD TAP & DIE DIVISION of United-Greenfield Corporation at Greenfield, Mass. Mr. Stimson has been gage sales manager and chief engineer of the gage division at GTD since 1944. He joined GTD in 1934.

Glen H. Stimson, chief engineer, Greenfield Tap & Die Division, United-Greenfield Corporation

ARTHUR E. HAMM was named a director of UNION TWIST DRILL CO., Athol, Mass., to fill the vacancy existing through the death of William E. Loy. PRICE - FLEURY - ARMSTRONG, INC., has been appointed sales representative for Union Twist Drill, Athol, Mass., and S. W. Card Division, Mansfield, Mass., in the states of Virginia, North Carolina, South Carolina, Tennessee, Alabama, Mississippi, Georgia, Florida, and southern Louisiana. The new organization will have the following officers: H. KENDALL PRICE, president; BEN A. FLEURY, vice-president and secretary; and ED W. ARMSTRONG, vice-president and treasurer. Union Twist Drill Co. and S. W. Card Division sales office and warehouse will continue at the present address: 1475 Spring St., N. W., Atlanta 9, Ga.

BROWN & SHARPE MFG. CO., Providence, R. I., announces that another milling cutter grinding and modification service company has been opened in Illinois for distributors and their customers by the Cutting Tool Division. The Brown & Sharpe Cutter Service Co. of Illinois is located in Bellwood, in metropolitan Chicago. The company has purchased HOWE & FANT, INC., East Norwalk, Conn., originator and manufacturer of turret-drilling and jigless work-positioning devices. HENRY D. SHARPE, JR., president of B & S, announced that Howe & Fant will become a subsidiary known as the Brown & Sharpe Turret Drilling Division, Inc. It will continue to



(Left) Henry J. Fredericks, vice-president, (center) Edward J. Shages, vice-president in charge of manufacturing, and (right) Jacob J. Jaeger, executive vice-president, Pratt & Whitney Co., Inc.

operate at the East Norwalk plant with its present personnel. Distribution of products of the new division will continue through Howe & Fant's existing dealers in the metalworking centers of the United States. ARNOLD CHARLAT, formerly the company's vice-president and chief engineer, becomes president of the new subsidiary, succeeding A. S. HOWE, JR. Mr. Howe will maintain his association with the firm and continue as a director.

JARVIS CORPORATION, Middletown, Conn., announces the opening of a new subsidiary in Burlington, Mass., to handle the design, manufacture, and distribution of special solid carbide tools. The new operation is under the direction of PAUL HANSCOME, general manager, assisted by FREDERICK WOLD.

BULLARD CO., Bridgeport, Conn., has announced the election to the board of directors of LEE S. JOHNSON, vice-president, United Aircraft Corporation, and general manager of Sikorsky Aircraft Division; and of PAUL L. SMITH, formerly controller of the Bullard Co., as treasurer. Mr. Smith succeeds FRANCIS L. DABNEY, now vice-president and secretary of Bullard Co., as treasurer.

GEORGE C. MOTT has joined HAMILTON STANDARD, division of United Aircraft Corporation, Windsor Locks, Conn., as production-control manager.

PRATT & WHITNEY CO., INC., West Hartford, Conn., has announced the appointment of three executives to new posts. JACOB J. JAEGER was named executive vice-president. HENRY J. FREDERICKS, treasurer-controller, has been named a vice-president. EDWARD J. SHAGES has been named vice-president in charge of manufacturing for all operations. Mr. Jaeger has been associated with the company since 1940, has been a vice-president since 1955, and was elected a director in 1956. Mr. Fredericks has served as treasurer-controller since April, 1957. He joined P & W in 1955. Mr. Shages has risen through the company ranks and was named vice-president and manager of the Cutting Tool & Gage Division in 1956.

THEODORE L. KISHBAUGH has been appointed general manager of the Wallingford, Conn., plant of JOSEPH T. RYERSON & SON, Inc. Mr. Kishbaugh joined Ryerson in 1946 as assistant manager of its Los Angeles plant. After two years he was named manager, remaining in this post until 1957 when he was appointed assistant vice-president with headquarters in the firm's Chicago offices.

T. L. Kishbaugh, general manager, Joseph T. Ryerson & Son, Inc.

## New York and New Jersey

The establishment of a new company—TRI-SECO, INC.—for the sale and distribution of machine tools, precision gages, and related equipment has been announced by JOSEPH G. BRADY, president. Home office of the new corporation is at 7 W. Broad St., Fleetwood, Mount Vernon, N. Y. Its area of operations will include New York, New Jersey, and Connecticut. In Connecticut the company will be represented by a resident sales engineer, ALBERT F. MILLER, JR., vice-president, who will make his headquarters in Bloomfield.

ROSE, KIMBALL & BAXTER, INC., 511 Baldwin St., Elmira, N. Y., has been appointed distributor for Latrobe over-size, flat-ground, die steel stock for the area of New York, which is manufactured by LATROBE STEEL CO., of Latrobe, Pa. The company announced that JOHN DUBLIN, manager of its industrial department, has been placed in charge of the Latrobe stock.

FRED G. OUTCALT has been appointed sales manager, LINDE DEPARTMENT, Union Carbide International Co., Division of Union Carbide Corporation. The sale of Linde Company products, as well as those of the other Corporate Divisions, is handled outside the United States and Canada by the International Co.

BEHR-MANNING CO. of Troy, N. Y., a division of Norton Co., has named THOMAS TROWBRIDGE general sales

# V-R TANTUNG®

## Designed for cutting speeds between high speed steel and carbides


**SOLID TOOL BITS**
•
**CUT-OFF BLADES**
•
**CAST-TO-FORM**
•
**TIPPED TOOLS**


"Where and How to use TANTUNG" — Facts about all types of TANTUNG tools . . . how to grind and braze . . . examples of production cost-savings, etc. Ask for Booklet No. 573.

V-R TANTUNG bridges the gap between maximum cutting speeds of high speed steel and practical minimum speeds of cemented carbides . . . and it's easy to grind with aluminum oxide wheels.

High red-hardness; high transverse rupture strength; low coefficient of friction and high shock resistance are a few of the characteristics which make TANTUNG cast alloy the ideal tool material for intermediate cutting speeds.

Ask your V-R representative to show you how TANTUNG can cut costs on many of your machining operations. He will also be glad to give you full information on V-R Ceramic and Carbide cutting tools for your higher speed jobs.

# V-R Vascoloy-Ramet corporation

PRIME MANUFACTURERS OF REFRACTORY METALS ENGINEERED FOR THE JOB

T-706

**862 Market Street • Waukegan, Illinois**

manager of its Coated Abrasive Division. THOMAS G. GILCOYNE was appointed field sales manager of the division.

J. H. WILLIAMS & CO., Buffalo, N. Y., announces the appointments of JOHN T. SCHANER as purchasing agent and FRANK J. WEBER as assistant purchasing agent.

The DOEHLER-JARVIS DIVISION of National Lead Co., New York City, has announced three executive changes. JOHN W. THEES has been named production manager for the division; CHARLES I. HODGSON becomes manager of Doehler-Jarvis Toledo, Ohio, Plant 1, succeeding Mr. Thees; and RICHARD M. HINDMAN has been appointed sales manager of the division's two Toledo plants, succeeding Mr. Hodgson.

(Left) Swan E. Bergstrom, president, and (right) Robert C. Bevis, a vice-president and director, Cincinnati Milling & Grinding Machines, Inc.

ADAMAS CARBIDE CORPORATION, Kenilworth, N. J., has announced the appointment of ERIC WERNER of TOOL SPECIALISTS, INC., as its southern New Jersey representative.

J & S TOOL CO., INC., Livingston, N. J., announced the appointment of the AMERICAN COLDSET CORPORATION, Teterboro, N. J., as national distributor and exclusive sales agent for its J & S "Contour Dresser."

JACK B. LARAMY has been appointed manager of sales of the WORTHINGTON CORPORATION, Harrison, N. J., Division.

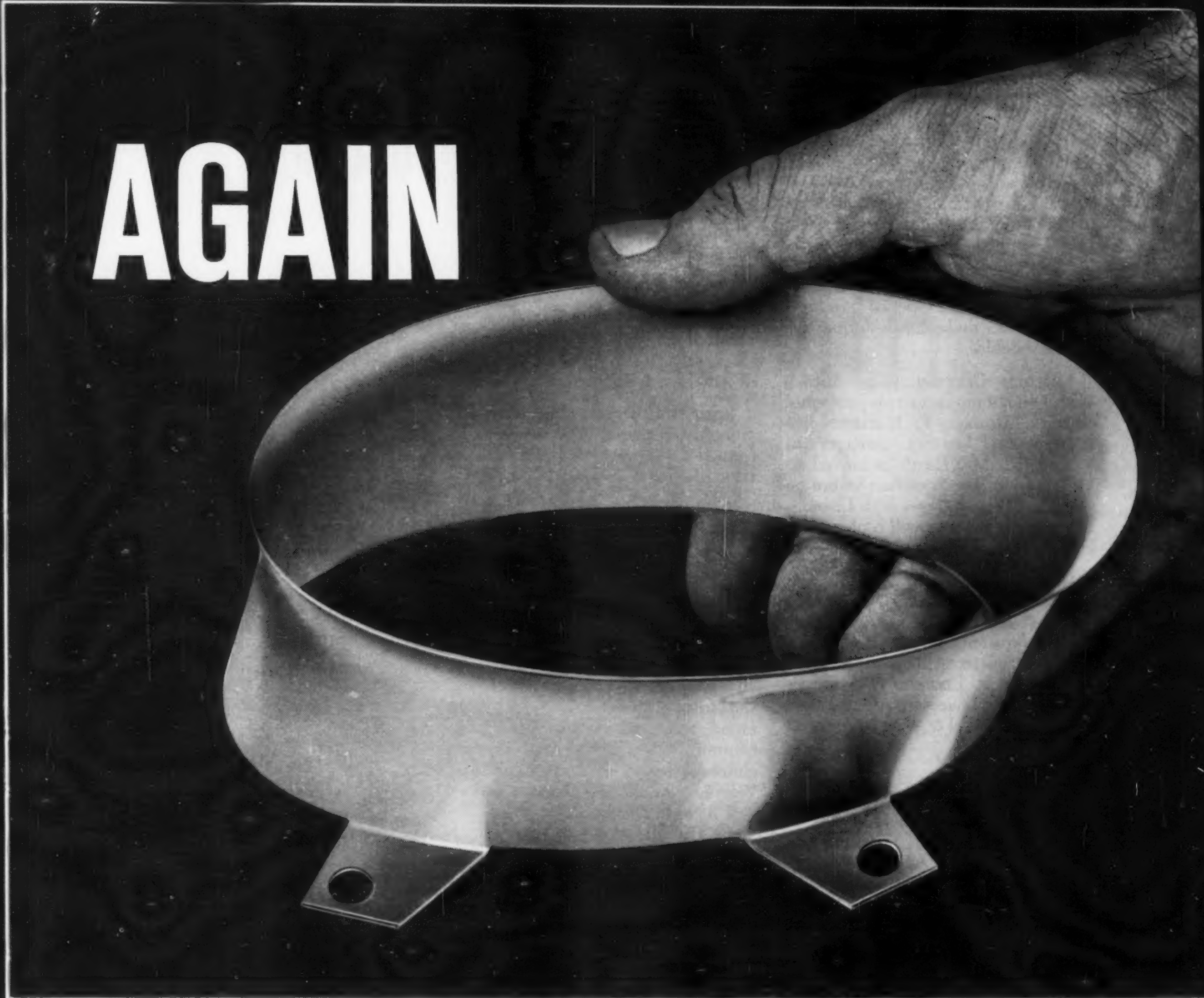
## Ohio

TIMKEN ROLLER BEARING CO., Canton, Ohio, announces the following appointments: PAUL J. REEVES has been designated vice-president in charge of sales. He succeeds W. B. MOORE, who retired in March. To fill vacancies created by his promotion, Mr. Reeves announced two executive changes in the Sales Division: ROBERT G. WINGERTER was named director of sales and S. T. SALVAGE became general manager of the Automotive Division. After serving the company in diverse capacities, Mr. Reeves was promoted to advertising manager in 1944 and director of sales in 1951, the position he held before becoming vice-president. Mr. Wingerter joined the company in 1938 as a sales trainee in the Industrial Division and has progressed steadily to his present position. Mr. Salvage joined the Timken Co. in 1933 as a sales engineering trainee. In 1958 he was named "Advertising Man of the Year."

CINCINNATI MILLING & GRINDING MACHINES, INC., Cincinnati, Ohio, announced that SWAN E. BERGSTROM was elected president and ROBERT C. BEVIS was elected a vice-president and director. Cincinnati Milling & Grinding Machines, Inc., is the sales subsidiary of the Cincinnati Milling Machine Co. Both have held many positions of importance, Mr. Bergstrom being president of the parent company and Mr. Bevis, sales manager of the sales subsidiary company.

E. W. BLISS CO., Canton, Ohio, has formed a new sales organization to handle special products and government contracts. The new group will be headed by ROBERT E. REILLY, who will make his headquarters at Canton. At present, Bliss is building a $5,000,000 140-foot diameter radio telescope for the

(Left) Robert G. Wingerter, director of sales; (center) S. T. Salvage, general manager, Automotive Division; and (right) Paul J. Reeves, vice-president, sales, Timken Roller Bearing Co.


AGAIN

National Radio Astronomy Observatory. Three other appointments to the Special Products sales force are: LEO P. SINCLAIR, JR., will become Washington representative. THOMAS F. LYNCH will be in charge of the Midwest and will make his headquarters at Canton. R. E. BAILEY will represent the Special Products Division and make his headquarters in Los Angeles.

LINCOLN ELECTRIC CO., Cleveland, Ohio, announces two personnel changes: DONALD F. HASTINGS has been named district manager in Moline, Ill. Mr. Hastings moved to Moline from San Francisco where he was a welding engineer with Lincoln. DONALD G. WRIGHT will replace him in California.

UNITED STATES STEEL CORPORATION, Cleveland, Ohio, announces the elevation of HARRY M. FRANCIS to the position of executive vice-president of its American Steel & Wire Division. EDWARD A. MURRAY was appointed vice-president–sales, of American Steel & Wire to succeed Mr. Francis.

CLEARING, division of U. S. Industries, Inc., Chicago, Ill., has announced the appointment of TECHNEERING SALES, INC., as its local dealer in southern Ohio for open-back inclinable and horning presses of up to 200 tons capacity.

TOM G. CONWAY has been appointed vice-president in charge of manufacturing of PESCO PRODUCTS DIVISION, Borg-Warner Corporation, Bedford, Ohio.

SUPER TOOL CO., division of Van Norman Industries, Detroit, Mich., has appointed the JOHN M. ALLEN CO., Cleveland, Ohio, as a distributor of its solid cemented-carbide and carbide-tipped cutting tools.

### Pennsylvania, Maryland, Virginia, and West Virginia

CARPENTER STEEL CO., Reading, Pa., has put into operation a new metallurgical control laboratory to provide faster service in the production testing of steels to customer specifications. The new facility enables Carpenter to examine and evaluate steel in manufacture up to five times as fast as was formerly possible, according to DR. CARL B. POST, vice-president and technical director. This speedup in testing time is expected to result in improved quality control and substantially faster delivery on orders.

DWIGHT W. KAUFMANN has been appointed manager of Tool Steel Sales for the CRUCIBLE STEEL COMPANY OF AMERICA, Pittsburgh, Pa. He succeeds A. H. LEWIS, who was named assistant to the works manager of the company's Sanderson-Halcomb plant in Syracuse, N. Y.

ROBERT J. OGDEN has been appointed manager of screw machine stock sales for Aluminum Company of America, Pittsburgh, Pa.

JOHN V. SUTTON has been appointed manager of the recently formed CONTRACT DIVISION of TEXTILE MACHINE WORKS, Reading, Pa.

JAMES J. MORAN has been appointed sales representative for the WARNER ELECTRIC BRAKE & CLUTCH CO., Beloit, Wis. He will make his headquarters at 928 Kevin Road, Baltimore 29, Md., and will supervise the firm's industrial sales and service activities in western Maryland, eastern Virginia, and Washington, D. C.

JAMES MCGRAW, INC., of Richmond, Va., has been appointed a distributor of Formsprag and Rawson clutches for the Formsprag Co., Warren, Mich. McGraw territory will include the entire state of Virginia. The McGraw firm has a branch in Front Royal and a sales office in Roanoke, Va.

RIVETT LATHE & GRINDER, INC., Boston, Mass., has appointed SCOTT EQUIPMENT CO., 3825 Jacob St., Wheeling, W. Va., as exclusive distributor in West Virginia and southeastern Ohio for the company's line of hydraulic valves, cylinders, and power units.

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### New Manufacturers' Association Formed

A new national, non-profit trade organization, to be known as the "National Institute of Jig and Fixture Component Manufacturers," has been recently formed. The following officers were elected at the organizing meeting: Erick W. Bergmann, Monroe Engineering Products, Inc., president; John Burke, West Point Mfg. Co., vice-president; and Harold Wrigley, Vlier Engineering Corporation, secretary-treasurer. Membership in the association is open to all qualified companies, and inquiries should be directed to the secretary-treasurer, at Vlier Engineering Corporation, 8900 Santa Monica Blvd., Los Angeles 46, Calif.

# Obituary

LEONARD H. MALSACK, secretary-treasurer of the Kempsmith Machine Co., Milwaukee, Wis., died in February at the age of fifty-nine. Mr. Malsack had been with the company for twenty-eight years, and was secretary-treasurer for the last twenty-five. He was active in civic and fraternal organizations.

Leonard H. Malsack

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### Solid Carbide Tool Institute Reorganized

Reorganization of the Solid Carbide Tool Institute was accomplished at a conference recently held in Chicago. The new Institute will provide standards on solid carbide tools for the industry and will develop and publish statistical information for its members. Standards on solid carbide end-mills, reamers, and drills have been developed by S.C.T.I. in conjunction with the Metal Cutting Tool Institute. These may be adopted by the American Standards Association. President of the reorganized S.C.T.I. is Herbert W. Fichtner, sales manager of Atrax Co., Newington, Conn. The Walter Gebhart Organization, 1015 Chestnut St., Philadelphia, Pa., was elected to serve as executive secretary and treasurer.

• • •

An article in MACHINERY sixty years ago described the mechanical equipment in the "world's highest office skyscraper"—309 feet tall and having twenty-six floors.

# PRECISION BORING


# with no rejects

*hole location accurate to ±.0001″*

*hole sizes repeated to ±.0001″*

## SAVE 300 HOURS PER UNIT

on precision boring of gear boxes. Each unit (2 halves) calls for over 200 holes, averaging 4 operations per hole and 3 setups per unit. Boring, spot facing, recessing, milling, tapping and counter boring. Material is magnesium alloy. Location tolerances ±.0001.

Boring time reduced from 800 hours to 500 hours per unit—with no rejects in all 50 parts—and every one accurate to ±.0001″ on hole size and location!

Mr. R. Schmidt of Triangle Tool Co., Union, N. J., owner of this Fosmatic Jig Borer, reports, "Two Fosmatic features were largely responsible for this important time saving. First, the Fosmatic's long table travel permitted machining two parts at once. Second, the automatic positioning and Direct Dimension Measuring System work simply and fast. They eliminate confusion and help the operator work accurately and efficiently. Incidentally, that long table travel helped get us several new jobs we could never have handled on our other jig borer."

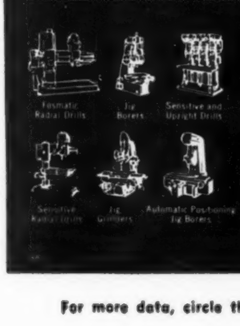
With Direct Dimension Measuring the operator sets dimensions direct from blueprint onto two direct reading drum dials. At the press of a button, the table automatically positions work to ±.0001″.

Fosmatic Jig Borers bring you many important advances in boring technology. Where progress has been so great, the obsolescence of your old machine may be more costly than you suspect. *Why not run a check?* Call your Fosdick Distributor or write us today.

**Buy a Fosmatic today—add Numerical Control Tomorrow**

Any tape or card reader can be used to control a Fosmatic. And because the functions of our machine are actuated electrically, numerical control can be installed in the field—economically. You can program all or as many functions as you wish! Write or call today for complete information.

*Ask for Fosmatic Jig Borer Bulletin JB-M*



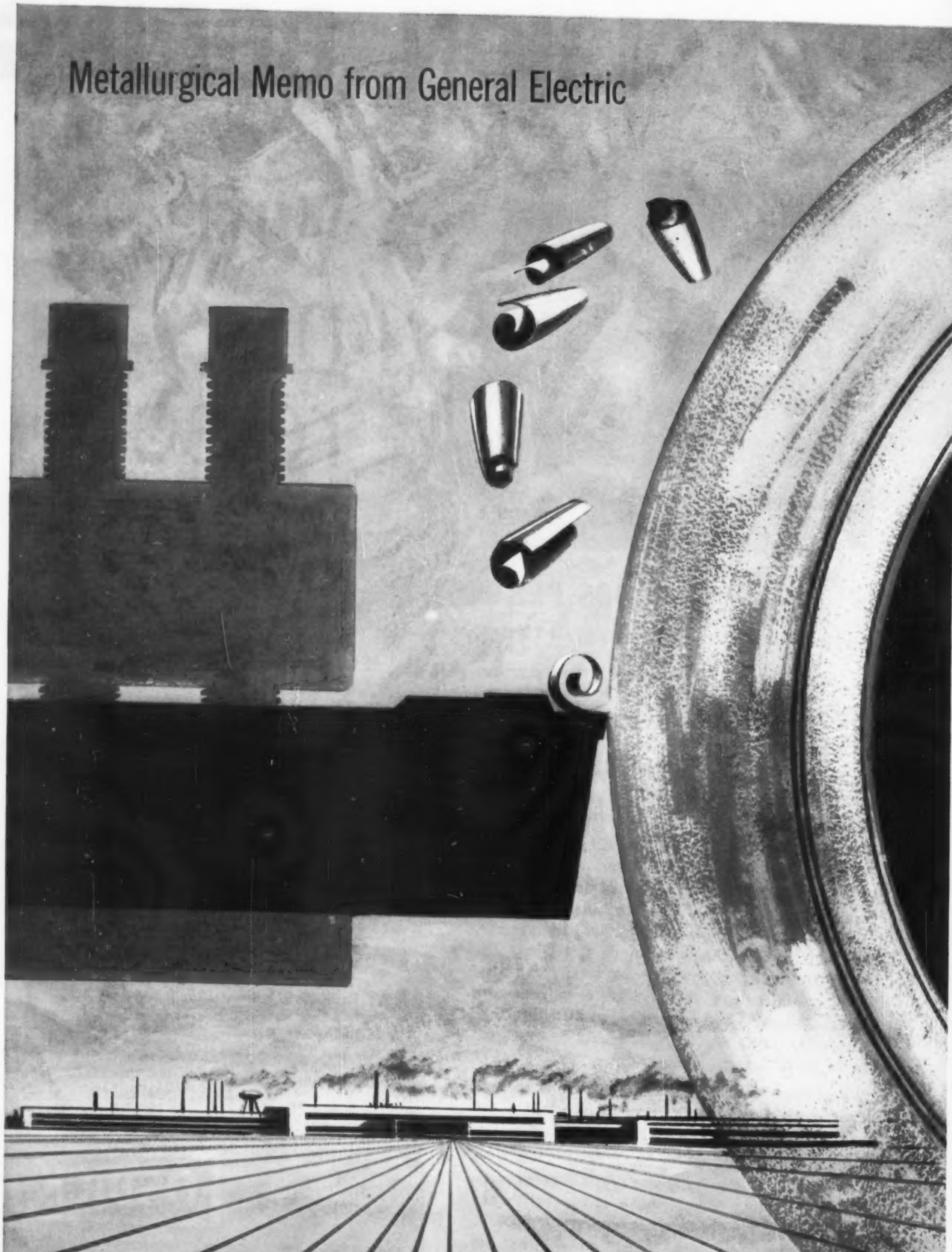

*Get a Proposal from*

FOSDICK

THE FOSDICK MACHINE TOOL CO.
CINCINNATI 23, OHIO



For more data, circle this page number on inquiry card


Metallurgical Memo from General Electric

# New Books and Publications

THE GRINDING WHEEL. By Kenneth B. Lewis. 532 pages; illustrated; 6 by 9 inches. 1959 revised edition. Published by the Grinding Wheel Institute, 2130 Keith Building, Cleveland 15, Ohio. Price, \$4.95.

This volume presents a discussion of grinding wheels, machines, and techniques from a basic as well as a practical standpoint. Opening chapters concern abrasive materials, wheel shapes and sizes, bonds, and wheel manufacture. Others explain the different grinding operations—cylindrical, surface, centerless, etc. Metalworking practices comprise the largest part of the book, but the grinding of ceramics, glass, marble, and concrete is also covered. Special chapters deal with the evaluation of surface quality, truing and dressing, grinding fluids, and factors affecting wheel selection.

The current revised edition is based on the 1951 edition, with much added information. Among new subjects are jig grinding, electrolytically assisted grinding, and optical projection grinding. Recent developments in contributory fields have been examined, such as automatic sizing, automatic loading and unloading, and man-made diamonds. One of the most valuable sections of the book is an eight-page trouble-shooting chart, and a sixteen-page wheel-selection chart.

MECHANICS OF MACHINERY. By C. W. Ham, E. J. Crane, and W. L. Rogers. 496 pages; illustrated; 6 by 9 inches. Published by McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, \$8.50.

This is the fourth edition of this volume, appearing in the McGraw-Hill Series in Mechanical Engineering. In this era of high speeds in industrial machinery, the subjects of kinematics and dynamics of machinery are of increasing importance to engineers. As before, this text is designed for a two-course sequence: Mechanism (Part I) and Kinematics and Dynamics of Machinery (Part II). The basic fundamental approach has been kept in this edition, and the material is again limited to that necessary to bring out principles and methods. The chapters include the following: Part I. MECHANISM. Introductory Considerations. Linkages and Flexible Connectors. Cams. Toothed Gearing—Spur Gears. Gear Types and Manufacturing Methods. Intermittent-motion Mechanisms. Trains and Mechanism. Part II. KINEMATICS AND DYNAMICS OF MACHINERY. Velocities in Machines. Accelerations in Machines. Static Forces in Machines. Inertia Forces. Balancing of Machinery. Force Analysis of a Gasoline Engine. Vibrations and Critical Speeds in Shafts. Gyroscopic Forces. Appendix. Problems.

ARC WELDING IN MACHINERY DESIGN AND MANUFACTURE. 224 pages; illustrated; gold embossed, board covers. Published by the James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio. Price, \$2 in U.S.A., \$2.50 elsewhere, postage paid.

The James F. Lincoln Arc Welding Foundation has published a new book to help designers and manufacturers of machinery of all types find answers to their questions in using welded-steel construction to lower costs and improve performance.

It presents ideas for the efficient use of steel in machine design and manufacture. Part I contains suggestions, check lists, and guides for designing better machines at lower costs; Part II contains reviews of seventy-three designs to illustrate how welded steel is used to solve problems of design and manufacturing. The book is cross-indexed as to types of machinery, types of components, and types of design or manufacturing problems.

INTRODUCTION TO FOUNDRY TECHNOLOGY. By D. C. Ekey and W. P. Winter. 296 pages; illustrated; 6 by 9 1/4 inches. Published by McGraw-Hill Book Co., 330 W. 42nd St., New York 36, N. Y. Price, \$7.

This book is intended to introduce the engineering student to the basic concepts of foundry technology. It is divided into two sections. The first is a series of lectures on the theoretical aspects of foundry technology, providing a functional perspective for the engineer whose profession requires correct decisions relative to the limitations and applications of the casting processes. The second is a "Practicum Section" providing operational information in the methodology of numerous foundry procedures and processes. These practicum lessons are roughly integrated with the lecture series. The development of craft skills is not a major objective, but the comprehensive treatment of job operations is intended to provide the engineering student with a more mature and realistic understanding of the casting processes.

The subject field has been reduced to important general areas, and fully outlined.

TROUBLE-FREE HYDRAULICS. By Ian McNeil. 121 pages; 122 illustrations; 5 1/2 by 8 1/2 inches. Published by the Ronald Press Co., 15 E. 26th St., New York 10, N. Y. Price, \$6.50.

This volume, a "Practical Handbook on Maintenance and Fault-Finding in Oil Hydraulic Machinery," has been written for practical engineers who have not had the time to study the theoretical aspects of hydraulics, but for whom concise and readily available information is essential. It gives step-by-step guidance on how to keep all types of hydraulic machinery running smoothly, and what to do if trouble develops. Twelve charts and thirty-four explanatory tables are supplied. They are applicable to all forms of hydraulic machinery—from machine tools to mobile equipment.

# Coming Events

APRIL 18-22—ASTE Annual Meeting to be held at the Schroeder Hotel, Milwaukee, Wis. Contact American Society of Tool Engineers, 10700 Puritan Ave., Detroit 38, Mich.; Harry E. Conrad, executive secretary.

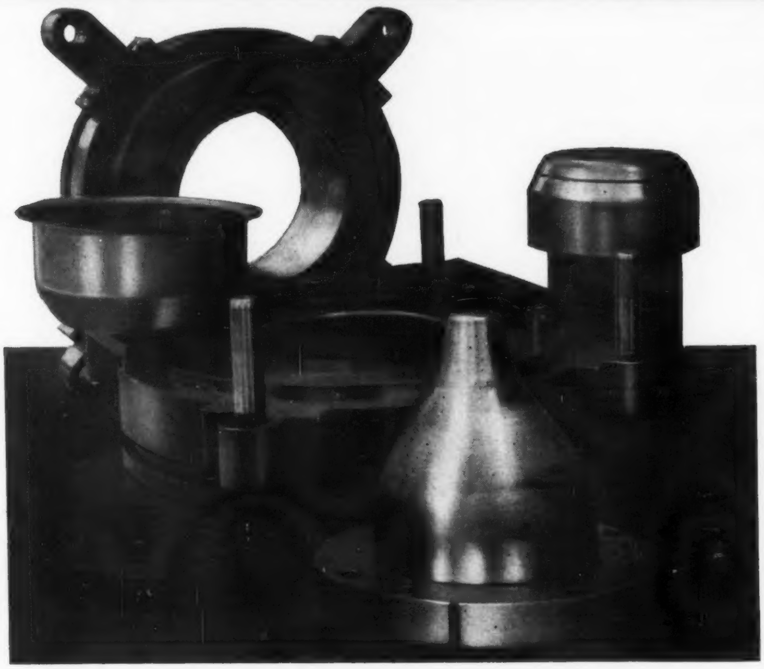
APRIL 26-30—Twenty-sixth Annual Meeting of National Screw Machine Products Association, at the Hotel Roosevelt, New York. For further information: National Screw Machine Products Association, 2860 E. 130th St., Cleveland 20, Ohio.

MAY 4-8—National Industrial Production Show of Canada at Exhibition Park, Toronto, Canada, under management of E. M. Wilcox, 19 Melinda St., Toronto, Canada.

MAY 25-28—Design Engineering Show at Convention Hall, Philadelphia, Pa., in conjunction with Fourth Annual Design Engineering Conference sponsored by the ASME. Further information may be had from Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y.

# Tool Steel Topics

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation
BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.



## Lehigh H makes deep draw... passes test with flying colors

It takes a deep draw to form these cone-shaped lamp shades from .025 in. steel sheet at Keystone Lamp Manufacturing Co., Slatington, Pa. The forming die frequently gave trouble, causing production to bog down.

The lamp maker contacted Luria Steel Supply Co., a distributor of Bethlehem tool steel. "We know the job is difficult," they said, "but perhaps you can tell us about a tool steel that will withstand such a deep draw."

The Luria representative had seen such problems before. "I'd recommend Lehigh H," he told them. "I've seen it handle plenty of tough applications. It has all the stamina you need for this job, and then some."

The Lehigh H die, hardened to Rockwell C60, performed just as he said it would. It had high surface hardness to prevent pickup and galling. Because of its high wear-resistance, it averaged 200,000 shades, a substantial increase. Only .010 in. had to be removed when redressing was necessary.

Lehigh H (AISI D-2) is our standard high-carbon, high-chromium grade of air-hardening tool steel. It is a deep-hardening grade with high compressive strength. It has high wear-resistance, plenty of toughness, and minimum size change during heat-treatment — the characteristics you need most for maximum production.

TYPICAL ANALYSIS

| | | |
|---|---|---|
| Carbon 1.55 | Chromium 11.50 | Molybdenum 0.80 |
| Manganese 0.40 | Vanadium 0.90 | |

The best way to appreciate the advantages of Lehigh H is to put it to work. A trial run in your shop can be arranged by your local Bethlehem tool steel distributor.

## BETHLEHEM TOOL STEEL ENGINEER SAYS:

### *You Can Remedy Fatigue-Failures*

Chisels and other tools which are subjected to repeated stresses often fail suddenly. Because these tools are made from shock-resisting steel, the sudden failures can appear mysterious. However, close inspection of the failed parts often reveals that the failures were not sudden at all. They occurred because a crack progressed part way through the section, followed by sudden fracture of the remaining section.

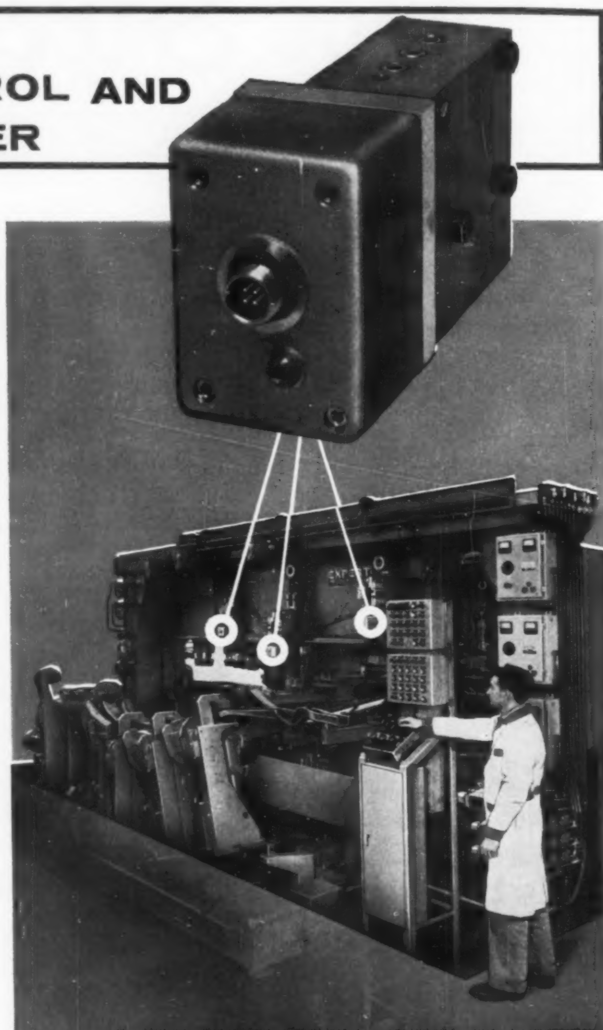
Fatigue-fractures have a characteristic, smooth-rubbed surface where the initial crack opened up, plus an inner crystalline zone revealed by the final sudden break. Often the smooth-rubbed surface shows parallel "oyster-shell" markings, and sometimes, evidence of rusting.

As a rule, fatigue-failures begin at a stress-concentration point, such as a notch, a poor fillet, tool mark, accidental nick, or deep stamping. The proper cure is to correct such design or mechanical faults promptly.

### *USE UPSET-FORGED DISCS FOR ALUMINUM EXTRUSIONS TOOLING*

Bethlehem produces a full line of upset-forged discs for the manufacture of dies for aluminum extrusions. The discs are forged by expert hammer crews. They are finished in ring dies to insure good section. You can choose from two grades of tool steel—Cromo-WV, chrome-moly-tungsten-vanadium (H-12), and Cromo-High V, chrome-moly-high vanadium (H-13). Each grade has good resistance to erosion and heat-checking.

# THE LINK BETWEEN ELECTRONIC CONTROL AND HYDRAULIC POWER



## Expert Welding Machine Co. Solves the High Production Contour Welding Problem With

# VICKERS.

## Electro-Hydraulic Servo Valve

The versatility of electro-hydraulic control of power has solved one of industry's toughest problems—automatic welding of complex and contoured automotive frame members.

An electronic probe follows the weld line on the work and records any deviation from the path prescribed by a master cam. Any deviation from the governing cam contour creates an error signal which is amplified and fed to the servo valve. The servo valve converts these electrical signals into precise hydraulic flow to a cylinder which accurately positions the welding head allowing for variations in manufacturing operations . . . trimming, etc.

This application is only one of many in which Vickers Servo Valve has demonstrated exceptional performance under the exacting conditions of industrial production requirements.

Valve operation is simple. Reliability is assured—there are only four moving parts.

Investigate the production advantages offered by electro-hydraulics. **Write for Vickers Engineering Bulletin 58-74.**

**EXPERT WELDING MACHINE COMPANY developed this automated welding machine that incorporates a magnetic-tape-tracer system. Vickers electro-hydraulic servo valve provides the link between electronic programming and hydraulic power. Vickers pumps and controls are also used. The machine joins metal parts having untrimmed, out-of-tolerance, straight and/or contoured weld line edges.**


**Two U-shape channels are welded to form the box configuration in this complex automotive frame side member. Production is approximately 100 pcs/hr.**

**VICKERS INCORPORATED**
DIVISION OF SPERRY RAND CORPORATION
**Machinery Hydraulics Division**
**ADMINISTRATIVE and ENGINEERING CENTER**
**Department 1403 • Detroit 32, Michigan**

8259

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**Field Service Headquarters Underlined. Whse. Stock & Repair Branches*.**

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

*Gets 40% savings in coolant costs by change to*

# Standard's Transparent Coolant

**ARGON Oil No. 4**

Chicago Saws, Inc., realizes other benefits in switch to this Standard Oil product

**Situation:** It all started when a Standard Oil lubrication specialist recommended ARGON Oil No. 4, Standard's transparent coolant to Chicago Saws for use in their grinding operations. This manufacturer of rotary saw blades decided to give it a try. They knew the product was the result of more than three years' work in Standard's research laboratory, and that it had been extensively field tested.

**What happened:** Using ARGON Oil No. 4 in 100:1 concentration, Chicago Saws was able to reduce coolant costs 40%. They also found the work could be seen more clearly when using this coolant. There was less wheel loading. They also discovered the coolant didn't foam and that its exceptional ability to carry off heat resulted in cooler operation. Faster cuts were obtained with finer wheels. Tolerances were easier to hold. Better finishes were obtained. Less frequent wheel dressings were required.

**What you can do:** Get more information about ARGON Oil No. 4 transparent coolant. Call the Standard Oil lubrication specialist near you in any of the 15 Midwest or Rocky Mountain states. Or write: **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**

Using ARGON Oil No. 4, Chicago Saws gets better finish at savings of 40% over other coolants tried. Operator is using .004" cut on heat treated Rockwell 60 C steel.

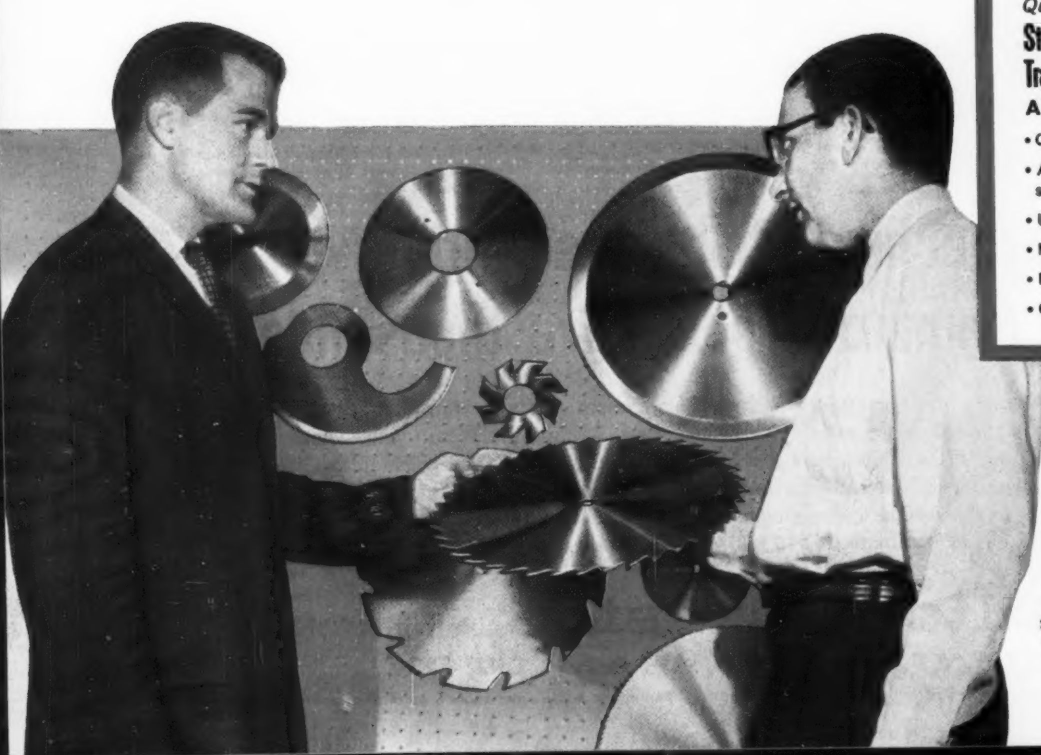
*You expect more from* **STANDARD** *and you get it!*

*Quick facts about*

**Standard's Transparent Coolant**

**ARGON Oil No. 4**

- Clear, transparent fluid
- All chemical. Does not support bacteria growth
- Unaffected by humidity
- Nonfoaming
- Fire resistant
- Odorless

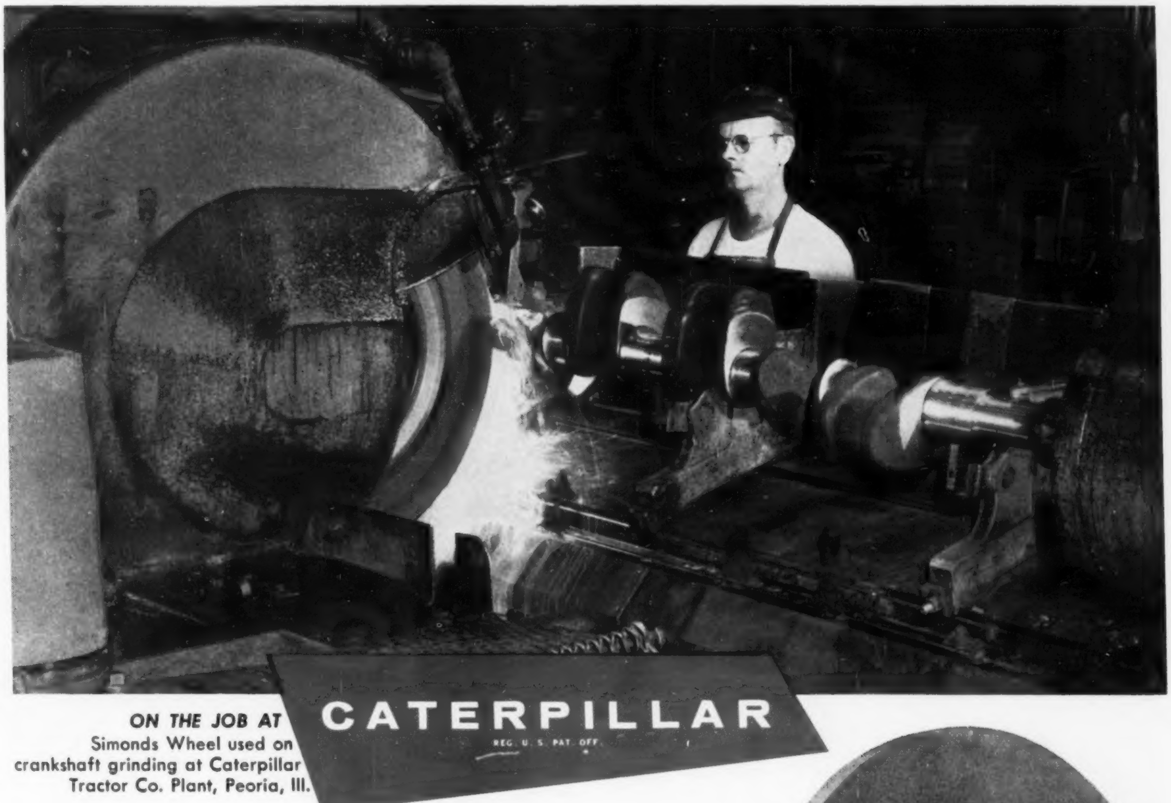


Standard's Bob Stark and Chicago Saws' vice president Paul Bostrom discuss blades and coolants. Bob Stark is well qualified to work with manufacturers on the use of metalworking coolants. Bob has a chemistry degree from Illinois College plus three years' experience at Standard. He has completed the Standard Oil Sales Engineering School course.

**OK . . . for precision grinding at high production speeds**

SIMONDS ABRASIVE CO.

# CRANKSHAFT GRINDING WHEELS




***ON THE JOB AT***
Simonds Wheel used on crankshaft grinding at Caterpillar Tractor Co. Plant, Peoria, Ill.

Fast and free-cutting these wheels hold up well on the corners, maintain radii and need only the minimum of dressing. Also supplied in matched, counter-balanced sets for multiple spindle set-ups . . . with each wheel marked with set number and with red stripe for accurate line-up on the spindle. Typical specifications for main or line bearings, JA543-05-V1 (multiple set-up) . . . for pin bearings, JA543-Q5-V1 (single wheel set-up). Write for Bulletin ESA 263.

**CALL YOUR SIMONDS DISTRIBUTOR**

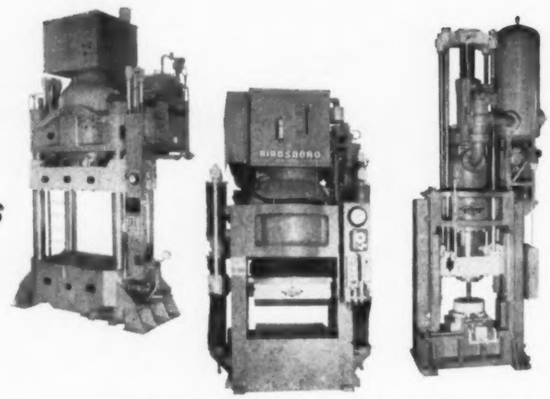
Proven products
Dependable know-how
Quick supply

**SIMONDS ABRASIVE COMPANY**
**Tacony & Fraley Sts., • Philadelphia 37, Pa.**
*Division of Simonds Saw and Steel Co.*

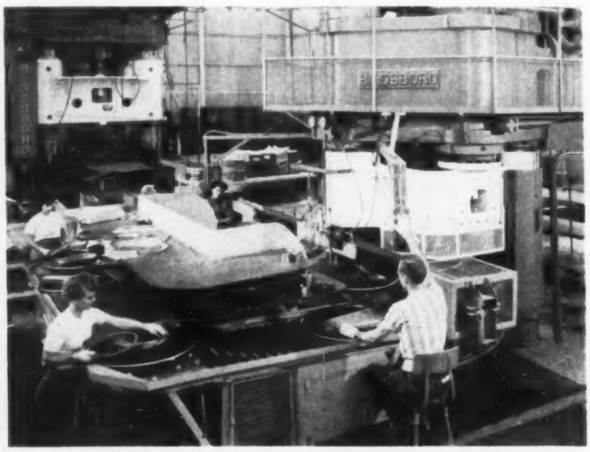
BRANCHES: CHICAGO • DETROIT • LOS ANGELES • PHILADELPHIA • PORTLAND, ORE. • SAN FRANCISCO • SHREVEPORT

*Get the most from both men and machines... with advanced design*

**BIRDSBORO** *Hydraulic Presses*



• Getting the most from your production crews depends a great deal on the equipment, and getting the most from your equipment depends a great deal on its design. As the importance of design increases, BIRDSBORO's emphasis on this factor has increased. Several BIRDSBORO hydraulic presses are being used in research *today* to determine the design features that will be needed to meet the performance requirement of *tomorrow*. Advanced design and versatility go into every press by BIRDSBORO. For reports on what they can mean to you, contact your BIRDSBORO representative. *Sales Department:* Reading, Pa., *Engineering Department and Plant:* Birdsboro, Pa., *District Office:* Pittsburgh, Pa.



HP-23-59

**BIRDSBORO**

STEEL FOUNDRY AND MACHINE CO.

BIRDSBORO HYDRAULIC

STEEL MILL MACHINERY • HYDRAULIC PRESSES • CRUSHING MACHINERY • SPECIAL MACHINERY • STEEL CASTINGS • Weldments "CAST-WELD" Design • ROLLS: Steel, Alloy Iron, Alloy Steel

For the Precision of a Count-down . . .

# T-J

## LAUNCHES A NEW CUTTING TOOL LINE FOR MILLING ACCURACY

For precision milling to close tolerances, so vital in today's high-speed, high-production manufacturing, T-J now offers a new, improved line of milling cutters. The new cutter line features a high helix angle, double back-off, and a right-hand spiral to produce more and smoother cuts between grinds, and a free-cutting, stronger tool.

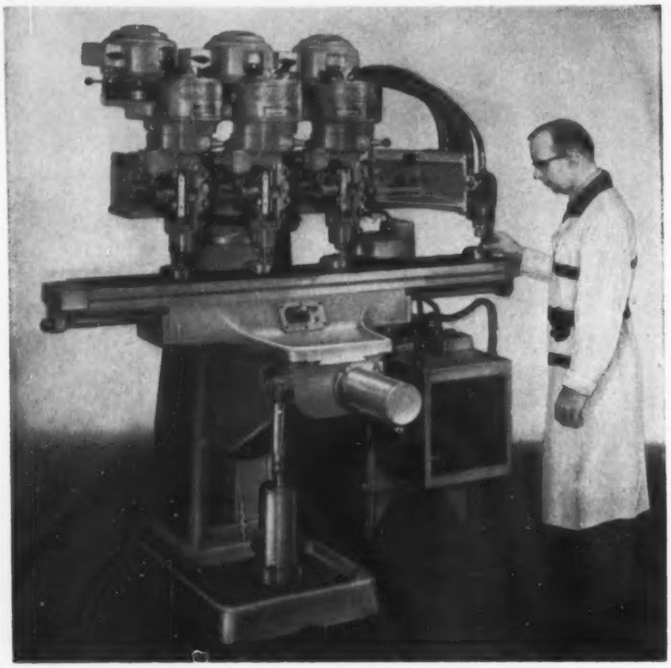
Specially designed and precision-manufactured for die sinking and production milling, the new line is designed to include flats on the shanks for set screw type drivers on all of the end and side milling cutters.

Write today for complete information to the Tomkins-Johnson Company, Jackson, Mich.

**Ask for completely new cutter catalogue No. 259.**

T-J

TOMKINS-JOHNSON



# Solve Your Duplicating Problems

with the

## Bridgeport

## HYDRAULIC TRACING MACHINE

**. . . for economy, performance, easy operation and speed**

*(Left) 3D T-Ram machine with 3 milling attachments. Also available with 2 attachments.*

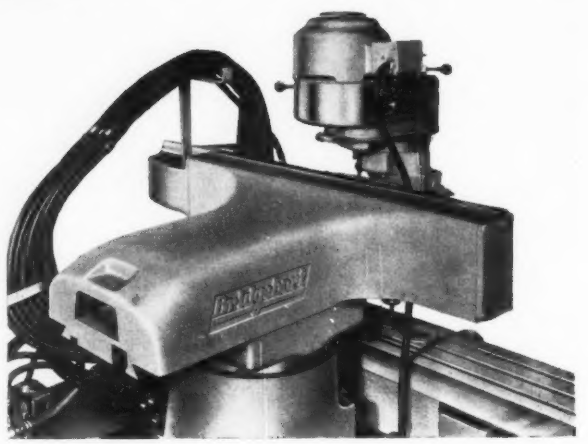
*(Below) T-Ram applied to 3D Duplicating machine greatly increases its capacity.*

This recent development converts the BRIDGEPORT MILLER into a duplicating machine unexcelled for accuracy, speed and ease of operation. It is designed integral with the basic machine and provides simultaneous, multiple-piece production in a single operation. Identified as the BRIDGEPORT T-Ram Tracing Machine, it is available in three models as follows:

ID . . . 180° with vertical 4″ feed hydraulic piston movement of knee.

2D . . . 360° with cross and longitudinal feed. Table longitudinal movement 28″; saddle transverse movement 12″.

3D . . . with vertical, cross and longitudinal feed. Hydraulic movements: Knee 4″; Table 28″; Saddle 12″.




Ways on all models are chrome plated for maintained accuracy, smooth operation and minimum wear. A one-shot lubricating system is provided. The inherent sensitivity and accuracy of the 3D machine is achieved by combining good design with proper application of the universally-accepted True-Trace 3D valve.

*Ask for more complete details from us or from your nearest dealer.*

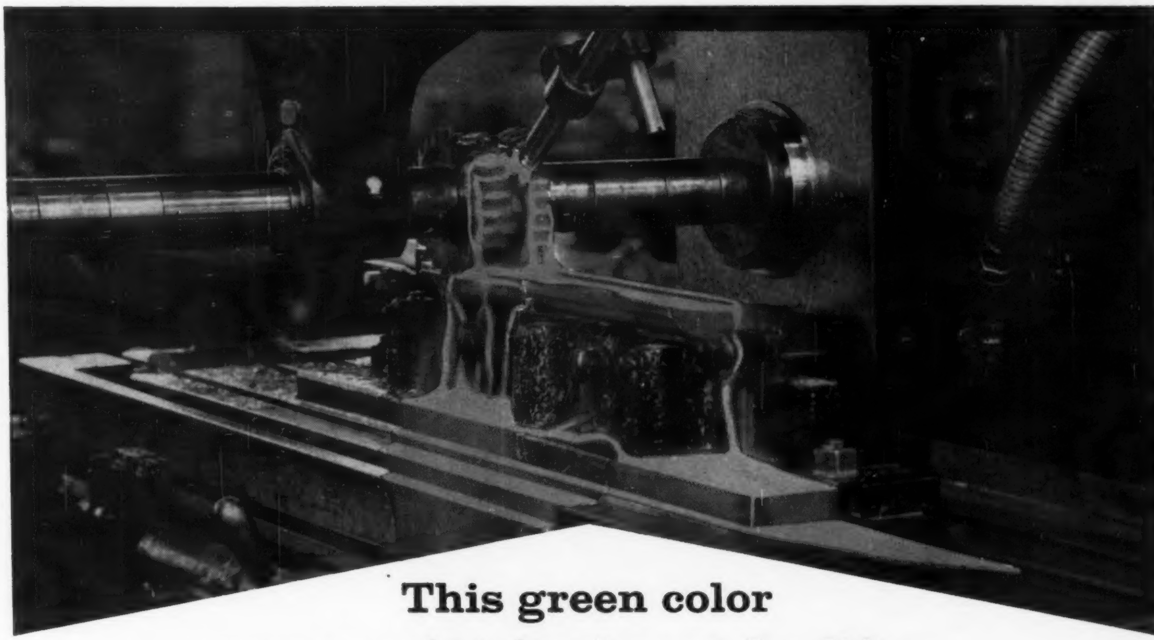
**Bridgeport MACHINES, INC.**

Bridgeport, Connecticut

Manufacturers of High Speed Milling Attachments and Turret Milling Machines

a "NEW LEAF" in coolants...


cools...
lubricates...
prevents rust...
stays mint-fresh for life!



This green color
means mint-freshness for life...

# it's NEW HOCUT 237

New HOCUT 237, Houghton's latest and most versatile synthetic cutting fluid, needs no expensive additive to stay permanently clear, clean and fresh in your machines, for months.

In plain dollars and cents, this means you seldom have to change coolants, you have less costly downtime, no dumping problems, and you get better work. Your plant stays clean and your operators stay happy. Best yet, HOCUT only costs a few pennies per gallon in your machines.

You can depend on HOCUT 237 for most every cutting or grinding operation in your plant. It cools work and tools quickly. A two-stage rust preventive protects work. Parts come off the machines faster, with finer finishes and closer tolerances.

For full information about new HOCUT 237, call your Houghton Man today. Or write: E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

**HOCUT 237** ... *a product of*

**E. F. HOUGHTON & CO.**
PHILADELPHIA • CHICAGO • DETROIT • SAN FRANCISCO • TORONTO

*Ready to give you on-the-job service*

# Product Directory

**To find headings easily, look for capital letters at top of each page to denote location.**

**ABRASIVE CLOTH, Paper and Belt**
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.

**ABRASIVES, Disc**
Gardner Machine Co., Beloit, Wis.
Macklin Co., Jackson, Mich.
Norton Co., 1 Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.

**ABRASIVES, Polishing, Tumbling, Etc.**
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
Macklin Co., Jackson, Mich.

**ACCUMULATORS, Hydraulic**
Erie Foundry Co., 1253 W. 12th St., Erie Penna.
Narda Hydraulics Corp., Mineola, N. Y.



**AIR GAGES, Dimensional**—See Gages Air Comparator

**AIR GUNS**
Chicago Pneumatic Tool Co., New York 17, N. Y.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

**AIR TOOLS**—See Grinders, Portable, Pneumatic—Drills, Portable, Pneumatic, Etc.

**ALLOY STEELS**
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Ryerson Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

**ALLOYS, Bearing**
Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Carpenter Steel Co., 105 W. Bern St., Reading Penna.
Mueller Brass Co., Port Huron, Mich.

**ALLOYS, Non-ferrous**—See Brass, Copper, Zinc and Stellite

**ALUMINUM and Aluminum Products**
Mueller Brass Co., Port Huron, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson & Son, Jos. T., 16th & Rockwell Sts., Chicago 8, Ill.

**ANGLE PLATES**—See Set-Up Equipment

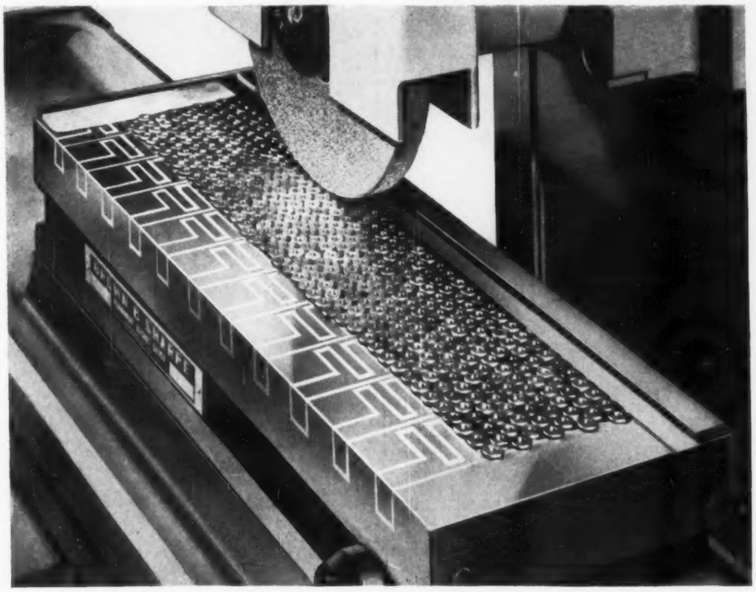
**ANNEALING FURNACES**
Eisler Engrg. Co., 750 So. 13th St., Newark 3, N. J.

**ARBOR PRESSES**—See Presses Arbor

**ARBORS AND MANDRELS**
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. (end mills)
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio
Jacobs Mfg. Co., West Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.

# Precision Tool News

No. 10 REPORTING NEW DEVELOPMENTS AT BROWN & SHARPE'S PRECISION CENTER



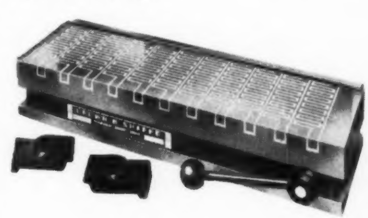
## Very small parts or thin strips held tightly and accurately on new B&S Fine Mesh Permanent Magnet Chuck

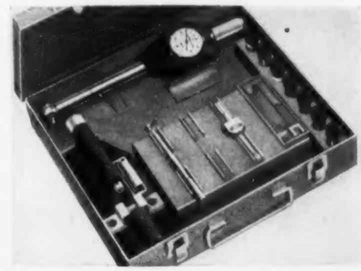
Magnetic poles are closer together on this new Brown & Sharpe chuck than on any other permanent magnet chuck. Closest spacing in the pattern is 3/32", and at no place within the magnetic area are poles more than 3/16" apart. As a result you can hold smaller parts — anywhere inside the area — without worrying about weak spots.

The extra-fine mesh also holds long, thin strips perfectly flat — without the waves that are apt to develop in strips when they're held on chucks with wider pole spacing.

You get exceptional accuracy with this chuck, because of its extra-thick, rigid top plate — that doesn't deflect or sag when the chuck is turned on. And, the thick top plate lasts longer, too — it can be dressed down a full 1/2".

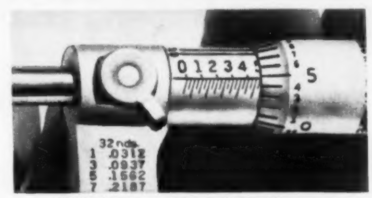
Brown & Sharpe's Fine Mesh Rectangular Permanent Magnet Chuck, No. 618-3, provides a working surface of 6" x 18"; magnetic surface for small, thin parts of 4 3/16" x 16 5/8". For larger, thicker pieces, its magnetic surface is a full 6" x 16 5/8".





## New B&S Dial Bore Gage Set Saves Up to 50% Cost Covering 1/8"-1" Range

Interchangeable arbors and measuring heads are used with one basic indicator assembly in the new Brown & Sharpe economy Dial Bore Gage Set. It covers measurements from 1/8" to 1", by .0001" — yet sells for only about $400 — *half* the cost of separate gages for this range. A bore-gage setting device that eliminates the need for setting rings is included.




## Oblique Graduations on New B&S Micrometer Prevent .025" Errors

Patented oblique (slanting) graduations on the *barrel* of Brown & Sharpe's Convertible Thimble Micrometer show quickly "where you've been and where you're going." They are still visible when older style straight graduations are hidden. They prevent the unfortunate .025", one-revolution errors that so often occur.

**Other features:** Thimble converts quickly to either friction or fixed type — floating, thumb-operated lever clamp. Personalized with initials at no extra cost. No. 1011 — Range, 0" to 1", in .0001".

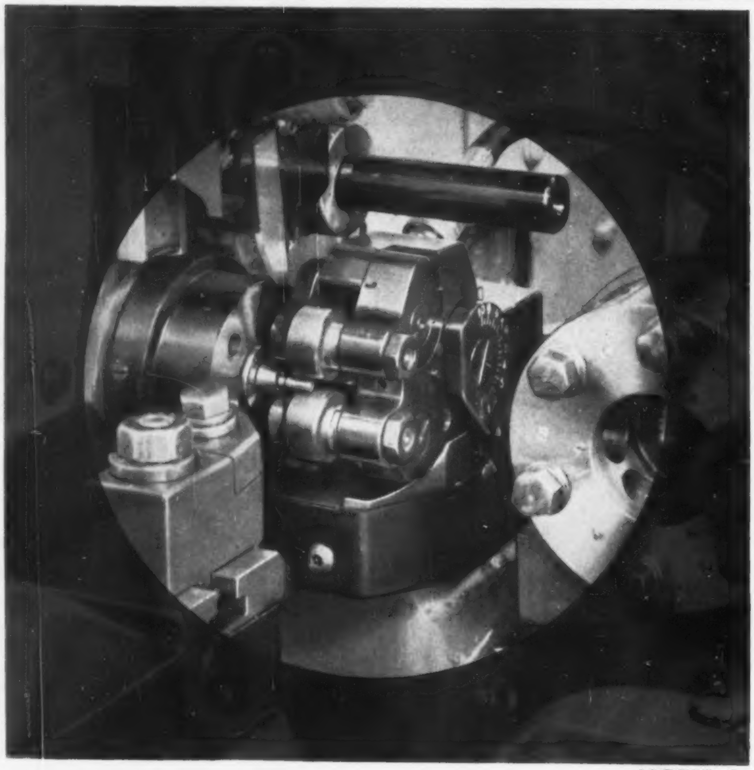
Ask your B&S industrial distributor to show how these new tools can save money or time in your own operation. Brown & Sharpe Mfg. Co., Providence 1, R. I.

**Brown & Sharpe**

**INDUSTRIAL PRODUCTS DIVISION**

PRECISION TOOLS AND GAGES
SCREW MACHINE TOOLS
SHOP ACCESSORIES

PROGRESS IN PRECISION FOR OVER 125 YEARS





 **For more data, circle this page number on inquiry card**

**ARC WELDERS**—See Welding Equipment, Arc

**ASSEMBLING MACHINES**

Detroit Power Screwdriver Co., 2799 W. Fort St., Detroit 16, Mich.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Sheffield Corp., Box 893, Dayton 1, Ohio

**AUTOMATIC SCREW MACHINES**—See Screw Machines, Single and Multiple-Spindle Automatic

**BABBITT**

Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

**BACTERICIDES**

Lilly, Eli and Co., Indianapolis 6, Ind.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.

**BALANCING EQUIPMENT**

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gisholt Machine Co. (Static and Dynamic), 1245 E. Washington Ave., Madison 10, Wis.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mach. Tool Co., 2531 11th St., Rockford, Ill.

**BALLS**

Hoover Ball & Bearing Co., Ann Arbor, Mich.
Kennametal, Inc., Latrobe, Penna.

**BAR MACHINES**—See Screw Machines, Single and Multiple-Spindle, Automatic

**BAR STOCK, Non-ferrous**

Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Mueller Brass Co., Port Huron, Mich.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
Shenango Furnace Co., Dover, Ohio

**BAR STOCK AND SHAFTING, Steel**

Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

**BEARING PILLOW BLOCKS AND CARTRIDGES**

Fafnir Bearing Co., New Britain, Conn.

**BEARINGS, Ball**

Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Fafnir Bearing Co., New Britain, Conn.
Hoover Ball & Bearing Co., Ann Arbor, Mich.
Japan Bearing Export Co., Ltd., Tokyo, Japan
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., 30th & Hunting Park Ave., Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S K F Industries, Inc., Philadelphia, Penna.

**BEARINGS, Bronze and Special Alloy**

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio


**BEARINGS, Oilless**

Bunting Brass & Bronze Co., 715 Spencer, Toledo 1, Ohio
Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

**BEARINGS, Roller**

Ball & Roller Bearing Co., Danbury, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., 541 Seymour St., Syracuse, N. Y.
S K F Industries, Inc., Philadelphia, Penna.
Timken Roller Bearing Co., Canton, Ohio

**BEARINGS, Thrust**

Ball & Roller Bearing Co., Danbury, Conn.
Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio
Fafnir Bearing Co., New Britain, Conn.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Rollway Bearing Co., Inc., Syracuse, N. Y.
S K F Industries, Inc., Philadelphia, Penna.
Timken Roller Bearing Co., Canton, Ohio

**BELTING, Transmission**

Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.

**BELT SANDERS**—See Grinding Machines, Abrasive Belt

**BENCH CENTERS**

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

**BENDERS, Bar, Tube, Channel, etc.**

Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

**BENDERS, Plate, Etc.**

Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

**BENDING MACHINES, Hydraulic**

Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engineering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Hydraulic Press Mfg. Co., Mount Gilead Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

**BENDING MACHINES, Pipe**

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

**BENDING ROLLS**

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland, Ohio
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

# Questions and Answers about ELCIDE 75

## *Here's what you'll want to know about this new bacterial inhibitor for soluble oil emulsions:*

**Q: What is Elcide 75?**

A: Elcide 75 is a new bacterial inhibitor for standard duty soluble oil emulsions. Chemically, it is a combination of Sodium Ethylmercuri Thiosalicylate (Thimerosal) and Sodium *o*-phenylphenate in a concentrated solution.

**Q: What does Elcide 75 do?**

A: Elcide 75 controls bacteria that contaminate soluble oil emulsions. Since both chemical ingredients are anti-bacterial agents, Elcide 75's double action controls a far wider range of bacteria than the commonly used germicides.

**Q: What is the exact dollar return from Elcide 75?**

A: No exact figure can be established because conditions vary between plants. The type of metal, machines, and operations involved, the coolant, and general plant housekeeping are all factors that help determine savings due to Elcide 75. The best way to measure its value is to try Elcide 75 and compare the results with untreated machines under your plant conditions.

**Q: How is Elcide 75 used?**

A: One ounce of Elcide 75 is added to each four gallons of emulsion. You know you have a safe, effective treatment because you control the dosage.


Bacteria like these prematurely spoil emulsions. Elcide 75 stops their damage.

**Q: Is Elcide 75 safe to employees?**

A: Yes. It also eliminates objectionable odors and certain bacteria that may cause skin infections.

**Q: Will Elcide 75 harm machinery or products?**

A: No. In fact, Elcide 75 controls bacteria that often cause acidic corrosion and shortened tool life.

**Q: Why is bacteria control important?**

A: Bacteria enter emulsions through the air, water, and plant debris. They multiply rapidly and cause odor, corrosion, and premature emulsion breakdown. This compounded damage costs millions of dollars each year in higher maintenance and production costs. Bacteria control reduces these expenses.

**Q: How does Elcide 75 lower operating costs?**

A: The use of Elcide 75 can increase emulsion life as much as 5½ times. You use less soluble oil. Fewer man-hours are spent servicing machines and disposing of waste oil. And, because machines run longer between emulsion changes, production is increased proportionately.

**Q: Is more information available on Elcide 75?**

A: Yes. Complete data on compatibility, disposal, stability, safety, and other pertinent factors are available on written request.

**Q: Where can I buy Elcide 75?**

A: Elcide 75 is sold only through selected distributors. To place your order, or for the name of your nearest distributor, write Eli Lilly and Company, Agricultural and Industrial Products Division, Indianapolis 6, Indiana; or telephone MElrose 6-2211.

**ELCIDE 75** TM

PATENT PENDING

KEEPS COOLANTS FRESH AS A DAISY!

(Lilly's brand of bacterial inhibitor for cutting fluids)

| Package | Price per Gal. |
|---|---|
| 1-gal. (4 per case), polyethylene | $8.50 |
| 5-gallon, polyethylene | $8.00 |
| 55-gallon, stainless steel | $6.50 |

ELI *Lilly* AND COMPANY • AGRICULTURAL AND INDUSTRIAL PRODUCTS DIVISION • INDIANAPOLIS 6, INDIANA



For more data, circle this page number on inquiry card

**BLAST CLEANING EQUIPMENT**
Pangborn Corp., Hagerstown, Md.

**BLOWERS**
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

**BLUING LAYOUT**
Dykem Co., 2307 N. 11th St., St. Louis 6, Mo.

**BOLT and NUT MACHINES**
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

**BOLTS, NUTS AND SCREWS**
Allen Mfg. Co., Bloomfield, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Northwestern Tools, Inc., 115 Hollier Ave., Dayton 3, Ohio.
Orban Kurt Co., Inc., 42 Exchange Place Jersey City 2, N. J.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

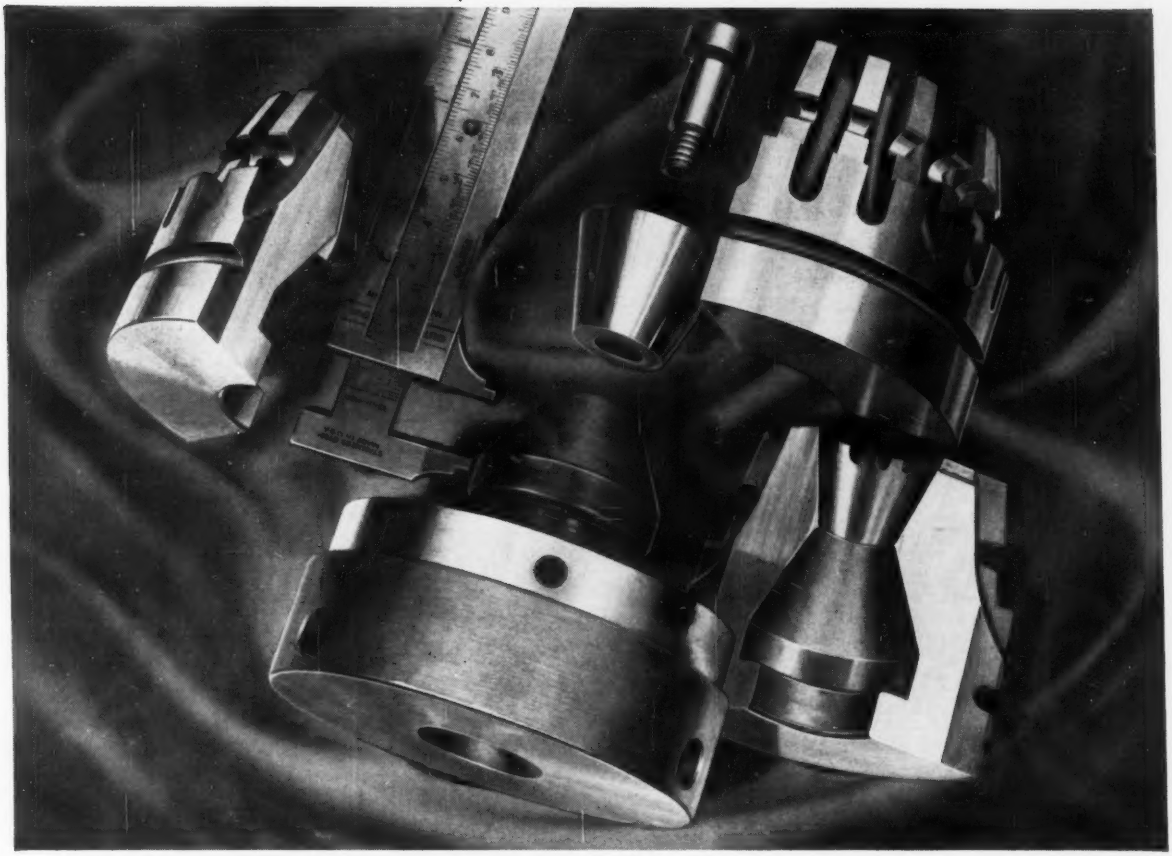
**BOOKS, Technical**
Industrial Press, 93 Worth St., New York 13, N. Y.

**BORING BARS**
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Kennametal Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 327, Roosevelt Park Annex, Detroit 32, Mich.
Universal Engineering Co., Frankenmuth 2, Mich.
Van Norman Machine Co., 3640 Main St., Springfield 7 Mass.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7 N. Y.

**BORING HEADS**
American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Bridgeport Machines, Inc., 500 Lindley St., Bridgeport 6, Conn.
Bryant Chucking Grinder Co., Clinton St., Springfield, Vt
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Mummert-Dixon Co., Hanover, Pa.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

**BORING MACHINES**
Baker Bros. Inc., 1000 Post Ave., Toledo 10, Ohio
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Bullard Co., Bridgeport 6, Conn.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N Y
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Davis & Thompson Co., 4460 N. 24th St., Milwaukee 10, Wis.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro. Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.

*(Continued on page 250)*



# INTRICATE SHAPES MADE EASY WITH GRAPH-AIR®

## *hardens at 200° to 300° lower than most air-hardening tool steels*

YOU can make intricate shapes like these easier and at less cost with versatile Graph-Air tool steel. Here's why:

**1) GRAPH-AIR AIR-HARDENS FROM AS LOW AS 1450°F.** That's as much as 400 degrees lower than most air-hardening tool steels. You reduce distortion, simplify heat treating control, minimize scaling and decarburization.

**2) GRAPH-AIR MACHINES FASTER.** The free graphite in its structure makes it machine 30% faster than ordinary tool steels. Means more production for you.

**3) GRAPH-AIR HAS MORE STABILITY.** It's one of the Timken Company's graphitic tool steels, the most stable tool steels ever made. Tests prove it. And that means longer accuracy for parts made of Graph-Air.

Uniform hardening, reduced distortion and all its other advantages allow you to machine Graph-Air into more intricate sections. It's a money-saving solution for blanking dies or other steel parts that must withstand abuse. For the best tool steel to make intricate shapes—the one that air-hardens at lower temperatures—specify Graph-Air. Available in solid and hollow bar sizes. Our metallurgists will help you select the most economical size for your needs. Write: The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable: "TIMROSCO". *Makers of Tapered Roller Bearings, Fine Alloy Steels and Removable Rock Bits.*

**WHEN YOU BUY TIMKEN STEEL YOU GET . . .**

1. Quality that's uniform from heat to heat, bar to bar, order to order
2. Service from the experts in specialty steels
3. Over 40 years experience in solving tough steel problems

# TIMKEN® *Fine Alloy* STEEL

**TIMKEN GRAPHITIC STEELS ARE CARRIED IN STOCK BY 9 DISTRIBUTORS WITH 42 WAREHOUSES IN 31 CITIES IN THE UNITED STATES AND CANADA**



For more data, circle this page number on inquiry card

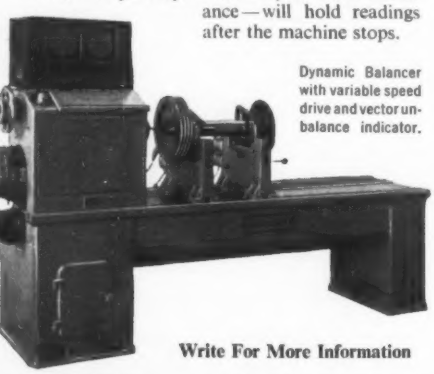
Gray Co., G. A., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Ingersoll Milling Mchn. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Machine Co., Springfield, Vt.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Moline Tool Co., Moline, Ill
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Olofsson Corp., Lansing, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893 Dayton 1, Ohio
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Wales-Strippit, Inc., Akron, N. Y.

**BORING MILLS, Horizontal**

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
DeVlieg Machine Co., Fair St., Royal Oak, Mich.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., 3611 Woodburn Ave., Cincinnati 7, Ohio.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain, Conn.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.



Static Balancer with associated drilling unit.



Dynamic Balancer with variable speed drive and vector unbalance indicator.



**BORING MILLS, Vertical**

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Berthiez, Charles, 5 Rue Montalivet, Paris, France
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Cosa Corp, 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
King Machine Tool Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
New Britain Mch. Co., New Britain, Conn.
Snyder Corp., 3400 E. Lafayette Ave., Detroit, 7, Mich.

**BORING TOOLS**

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**BRAKES, Press and Bending**

Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Ferracute Machine Co., Bridgeport, N. J.
Lodge & Shipley Co., Hamilton 1, Ohio
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

**BRASS**

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass, Inc., 230 Park Ave., New York, N. Y.

**BROACHES**

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

**BROACHING MACHINE, Internal**

Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Wilson, K. R., Inc., 211 Mill St., Arcade, N. Y.

**BROACHING MACHINE, Surface**

Cincinnati Milling & Grinding Mchs., Inc., Cincinnati, Ohio.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.

**BRONZE**

American Brass Co., Waterbury 20, Conn.
Mueller Brass Co., Port Huron 35, Mich.

**BRUSHES, Industrial, Tampico, Wire Wheel, Etc.**

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

**BUFFERS**

Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

**BULLDOZERS, Metalforming**

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.

**BURNISHING MACHINES**

Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

**BURRING MACHINES**—See Deburring Machines

**BURRS**—See Files and Burrs, Rotary

**BUSHINGS, Drill Jig**

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

**BUSHINGS, Hardened Steel**

Universal Engrg. Co., Frankenmuth, Mich.

**BUSHINGS, Non-ferrous and Powdered Metal**

Bunting Brass & Bronze Co., 715 Spencer, Toledo, Ohio.
Universal Engrg. Co., Frankenmuth, Mich.

**CALIPERS, Spring, Firm-Joint, Transfer, Hermaphrodite, etc.**—See Layout and Drafting Tools, Machinists' Small Tools

**CALIPER, Vernier**

Brown & Sharpe Mfg. Co., Providence, R. I.
DoALL Co., Des Plaines, Ill.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

**CAM CUTTING MACHINES**

Cincinnati Milling & Grinding Mchs., Inc., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York, 17, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

**CAMERAS, High Speed**

Wollensak Optical Co., Rochester 21, N. Y.

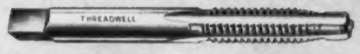
**CAM MILLING AND GRINDING MACHINES**

American Schiess Corp., 1232 Penn Ave., Pittsburgh 22, Pa.
Baird Machine Co., 1700 Stratford Ave., Stratford, Conn.
Cincinnati Milling Machine Co., Oakley, Cincinnati, Ohio.
Landis Tool Co., Waynesboro, Pa.
Rowbottom Machine Co., Waterbury, Conn.

**CAMS**

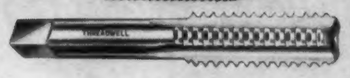
Brown & Sharpe Mfg. Co., Providence, R. I.
Eisler Engrg. Co., Inc., 750 S. 13th, Newark 3, N. J.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Rowbottom Machine Co., Waterbury, Conn.

*First* with piloted taps . . . . . . . . . . . . .



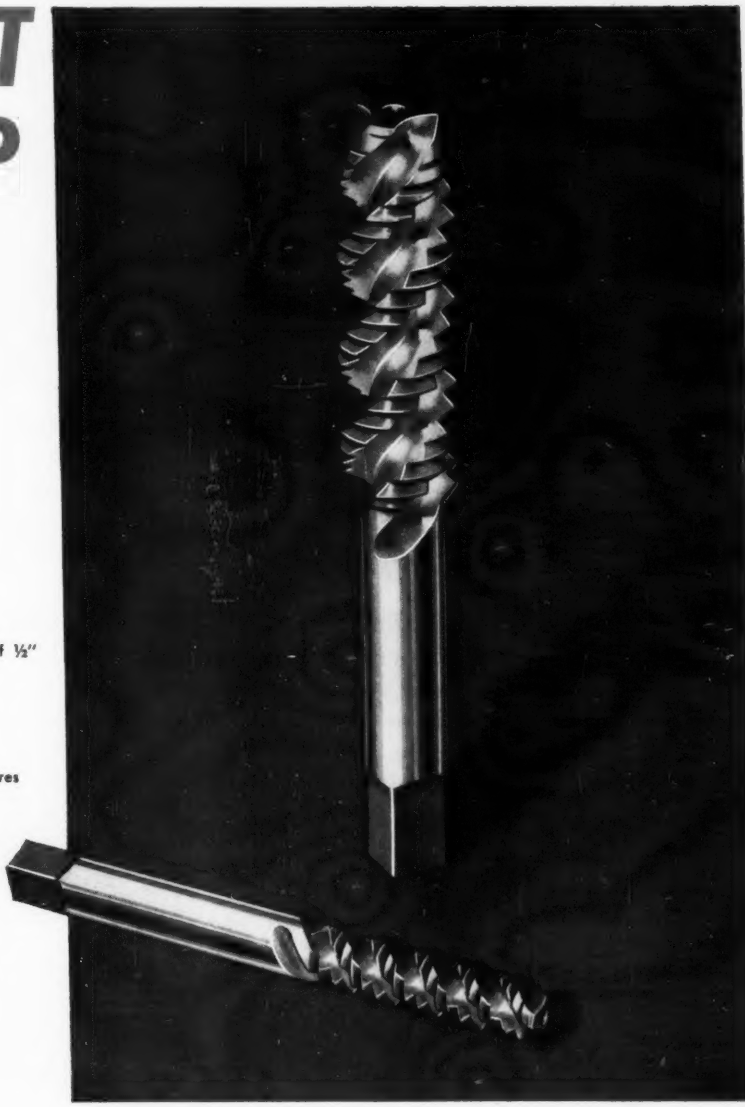

*First* with TCI taps (for cast iron) . . . . . . . . . . .

*First* with interrupted thread taps as standard . . . . . . . .



# NOW *Threadwell introduces the revolutionary new*

# TURBO-CUT TAP



- **Maximum chip removal**
- **Utmost accuracy**
- **Reduced tap breakage**
- **Ideal for ductile materials**
- **Fine for blind holes**
- **Excellent in deep holes**

*Look at the proven performance:*

FIELD TEST #1
Midwest Manufacturer of Tapping Units
Part: Aluminum grommet drilled to a depth of ½"
Operation: Tapping ⅜" deep
Production: 70 pieces/minute
Result: 18,000 holes tapped with one #10-24 "Turbo-Cut" Tap and *still* usable.

FIELD TEST #2
New England Manufacturer of Plumbing Fixtures
Part: Polystyrene bathroom accessory
Operation: Tapping
Production: 50,000 holes tapped with one ¼-20 "Turbo-Cut" Tap and *still* usable.
This is not a misprint.

*See your Threadwell Distributor for complete details or write direct to:*

Threadwell

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**THREADWELL TAP & DIE COMPANY Greenfield, Mass., U.S.A.**



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**CARBIDES**
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
DoAll Co., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Penna.
Linde Co., 30 E. 42nd St., New York 17, N. Y.
Metal Carbides Corp., Youngtown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

**CASTINGS, Die**
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

**CASTINGS, Non-ferrous**
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Shenango Furnace Co., Dover, Ohio
Textile Machine Works, Reading, Penna.
Vascoloy-Ramet Corp., Waukegan, Ill.

**CASTINGS—Gray Iron, Malleable**
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Malleable Castings Council, 1800 Union Commerce Bldg., Cleveland 14, Ohio
Shenango Furnace Co., Dover, Ohio
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Textile Machine Works, Reading, Penna.

**CASTINGS, Steel, Stainless, etc.**
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa

**CENTER-DRILLING MACHINES**
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

**CENTER PUNCHES**—See Machinists' Small Tools

**CENTERS, Grinding Machines, Indexing Head and Lathe**
Houston Grinding & Mfg. Co., Inc., Houston 8, Texas.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

**CERAMIC TOOL MATERIAL**—See Tool Material, Ceramic

**CHAINS, Power Transmission and Conveyor**
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.

**CHUCKING MACHINES, Multiple-Spindle Automatic**
Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.

Olofsson Corp., 2729 Lyons Ave., Lansing, Mich.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

**CHUCKING MACHINES, Single-Spindle Automatic**

Bullard Co., 286 Canfield Ave., Bridgeport 6, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 83, Ohio.

**CHUCKS, Air Operated**

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

**CHUCKS, Collet**

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jacobs Mfg. Co., West Hartford 10, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland 14, Ohio
Universal Engrg. Co., Frankenmuth 2, Mich.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**CHUCKS, Combination Universal-Independent**

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck Co., Windsor Locks, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

**CHUCKS, Compensating**

Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

**CHUCKS, Diaphragm**

Woodworth, N. A. Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

**CHUCKS, Drill, Key Type**

Jacobs Mfg. Co., West Hartford, Conn.

**CHUCKS, Drill, Keyless**

Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.

**CHUCKS, Full Floating**
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

**CHUCKS, Gear**
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Horton Chuck Co., Windsor Locks, Conn.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.

**CHUCKS, Independent**
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck Co., Windsor Locks, Conn.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

**CHUCKS, Lathes, etc.**
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck, Windsor Locks, Conn.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

**CHUCKS, Magnetic**
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
L-W Chuck Co., Toledo 4, Ohio
Sundstrand Mch. Tool Co., 2531—11th St., Rockford, Ill.
Walker, O. S. Inc., Worcester, Mass.

**CHUCKS, Power Operated**
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Gisholt Mch. Co., Madison 10, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.

**CHUCKS, Quick Change and Safety**
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Jacobs Mfg. Co., West Hartford 10, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.

**CHUCKS, Ring Wheel**
Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.

**CHUCKS, Tapping**
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Jacobs Mfg. Co., West Hartford, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill.

**CHUCKS, Universal Three-Jaw**
Buck Tool Co., 2015 Schippers Lane, Kalamazoo, Mich.
Gisholt Mch. Co., Madison 10, Wis.
Horton Chuck Co., Windsor Locks, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

**CHUCKS, Wrenchless**
Gisholt Mch. Co., Madison 10, Wis.

**CLAMPS, "C", Toggle, Toolmakers' Parallel**—See Set-Up Equipment

**CLEANERS, Metal**
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.
Oakite Products, Inc., 26 Rector St., New York, N. Y.

**CLUTCHES**
Cleveland Punch & Shear Works, Co., 3817 St. Clair Ave., Cleveland 14, Ohio.
Conway Clutch Co., 2747 Colerain Ave., Cincinnati 25, Ohio.
Minster Mch. Co., Minster, Ohio.

**COLD HEADING**
National Machinery Co., Tiffin, Ohio.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

**COLLETS**—See Chucks, Collet

**COMBINATION SQUARES**—See Machinists' Small Tools

**COMPARATORS, Dial, Electronic and Air**
DoALL Co., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Sheffield Corp., Box 883, Dayton 1, Ohio.
Starrett, L. S., Co., Athol, Mass.

**COMPARATORS, Optical**
Bausch & Lomb Optical Co., Rochester, N. Y.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Opto-Metric Tools, Inc., 137 Varick St., New York 13, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

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# a machinist's DREAM!!

## A REALLY NEW MACHINE

**THAT –**

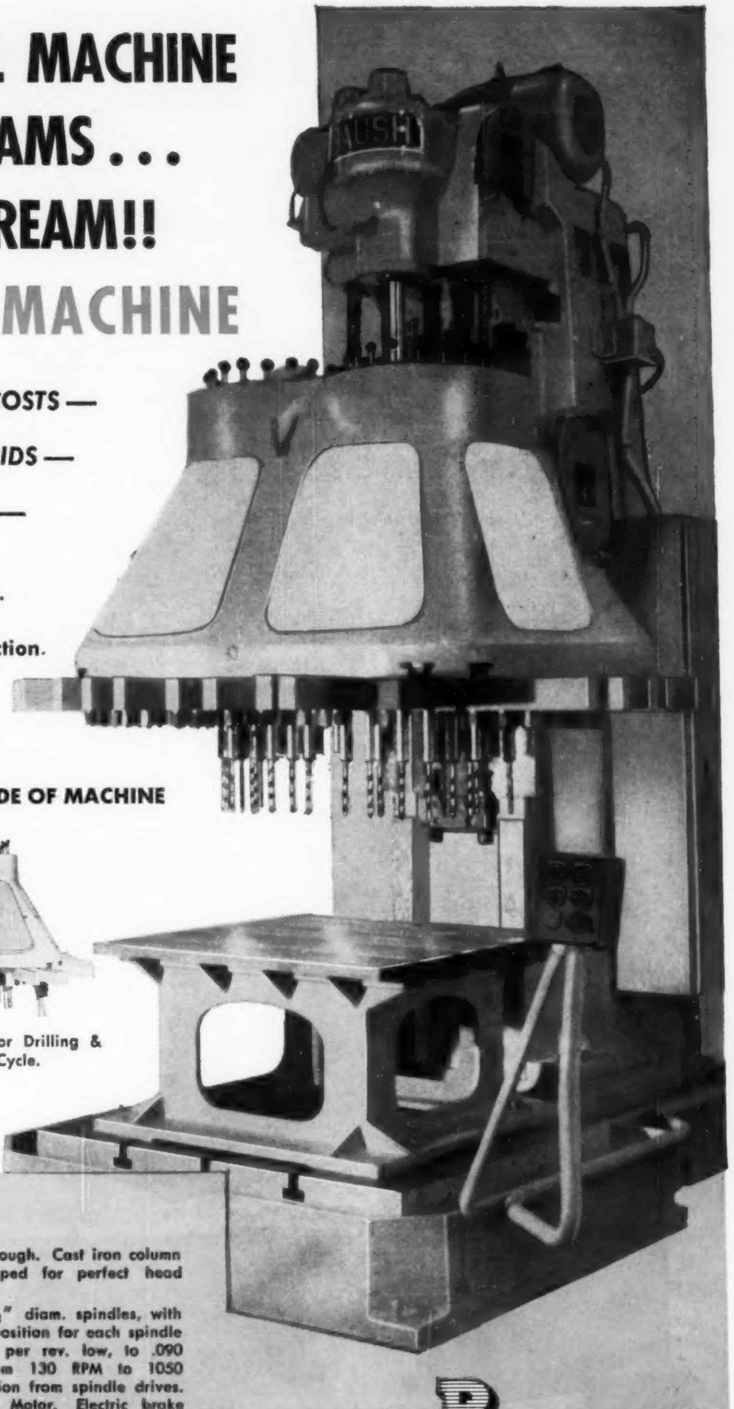
***CUTS INDIRECT MAINTENANCE COSTS —***
**Your own mechanics maintain unit.**

***HAS NO COSTLY HYDRAULIC FLUIDS —***
**No troublesome leaks to locate.**

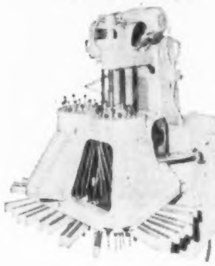
***INSURES STEADY, POSITIVE FEED —***
**Insures greater tool life.**

***ELIMINATES SURGE —***
**Even on breakthru. No tool breakage.**

***3 DIFFERENT CYCLES —***
**Completely automatic for high production.**
**Semi-Automatic for low production.**
**Jog cycle for set-up work.**

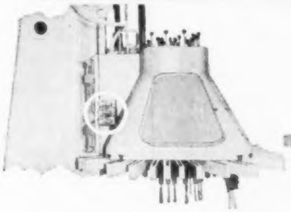



**TOP OF HEAD**



Two Independent Spindle Speeds and Neutral position on each Spindle controlled by knobs.

**LEFT-HAND SIDE OF MACHINE**



Control for Drilling & Tapping Cycle.

**SPECIFICATIONS:**

Heavily ribbed cast iron base has large coolant trough. Cast iron column is ribbed, and accurately machined ways scraped for perfect head alignment.

27" x 40" Rectangular Head, bored for (32) 1½" diam. spindles, with two (2) independent spindle speeds, and neutral position for each spindle when not in use. Feed is variable from .005 per rev. low, to .090 per rev. high, with spindle speed range from 130 RPM to 1050 RPM. Feed is thru ball screw with minimum friction from spindle drives. Rapid head traverse accomplished with 1 HP. Motor. Electric brake holds lead-screw and shuts off motor when head goes from rapid traverse to feed stroke. Spindle drive rotates on a ball nut on locked lead-screw to give pre-set feed for tool. Spindles are slip-sleeve, adjustable arm type, used with master-bored cluster plate. 2 to 1 Spindle speed ratio.

Lubrication can be manual or automatic. Electric controls are J.I.C.

**Motors:**
1-20 HP 1800 RPM for spindle drive
1- 1 HP 900 RPM for rapid traverse.

**Floor space 88" x 56"   Weight 18,000 lbs.**

**BAUSH**
**MACHINE TOOL CO.**
**SPRINGFIELD 7, MASSACHUSETTS**


For more data, circle this page number on inquiry card

**COMPOUNDS, Cleanings**—See Cleaners, Metal

**COMPOUNDS, Cuttings, Grinding, Metal Drawing, etc.**—See Cutting and Grinding Fluids

**COMPRESSORS, Air**

Chicago Pneumatic Tool Co., New York 17, N. Y.

**CONTOUR FOLLOWER**—See Tracing Attachments

**CONTRACT WORK**

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Eisler Engrg. Co., 750 S. 13th St., Newark 3, N. J.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Hartford Special Machinery Co., 287 Homestead St., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
National Acme Co., 170 E. 131st St., Cleveland Ohio.
Textile Machine Works, Reading, Penna.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

**CONTROLLERS**

Allen-Bradley Co., 1331 S. 1st St., Milwaukee, Wis.

**CONVEYORS FOR DUST, CHIPS, ETC.**

Barnes, W. F. & John Co., Rockford, Ill.

**COPPER**

American Brass Co., 25 Broadway, New York, N. Y.
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

**COUNTERBORES AND COUNTERSINKS**

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cogsdill Twist Drill Co., Greenfield, Mass.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Mohawk Tools, Inc., Montpelier, Ohio
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

**COUNTERS**

Starrett, The L. S., Co., Athol, Mass.

**COUPLINGS**

Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Mueller Brass Co., Port Huron, Mich.
Schrader's Sons, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Walker Co., Inc., O. S., Rockdale St., Worcester, Mass.

**CRANES, Electric Traveling**

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

**CUTTERS, Keyseating**

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
DoALL Co., Des Plaines, Ill.
Mitts & Merrill, 1009 So. Water St., Saginaw, Mich.


*make it logical . . . . easier, too!*

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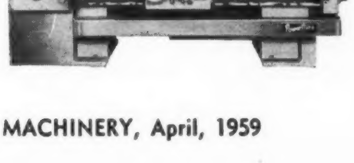
In turning . . . as in every manufacturing operation . . . there are "economic facts of life." Industry constantly demands more and better production at lower cost. This need has been filled by POWERTURN Lathes – demonstrated by case histories (available on letterhead request), which reveal thousands of dollars in cost reduction and higher output.

Base *your* replacement decision on a comparison of *any equipment* with the economic advantages assured by a really new Lodge & Shipley Lathe. POWERTURN facts will help you make a logical decision.

See details in Sweet's Machine Tool File, contact local representative through Yellow Pages or write direct for Bulletin L-104.

**The Lodge & Shipley Co., 3057 Colerain Ave., Cincinnati 25, O.**

*Lodge & Shipley POWERTURN . . . faster, more accurate and specifically designed for newest cutting techniques and toughest alloys.*



**Lodge & Shipley** . . . your LODGE-ical choice

**CUTTERS, Milling**
Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill. (end mills)
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorton, George, Mch. Co., 1321 Racine St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Kennametal, Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Tomkins-Johnson Co., Jackson, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

**CUTTING AND GRINDING FLUIDS**
Cincinnati Milling Products Div., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoALL Co., Des Plaines, Ill.
Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.
Oakite Products, Inc., 26 Rector St., New York 6, N. Y.
Shell Oil Co., 50 W. 50th St., New York, N. Y.
Sinclair Refining Co., 600 Fifth Ave., New York, N. Y.
Texas Co., 135 E. 42nd St., New York, N. Y.

**CUTTING-OFF MACHINES, Lathe Type**
Bardons & Oliver, Inc., 1133 W. Ninth St., Cleveland 13, Ohio
Brown & Sharpe Mfg. Co., Providence, R. I.
Modern Machine Tool Co., Jackson, Mich.



**CUTTING-OFF SAWS, Abrasive Wheel**
DoALL Co., Des Plaines, Ill.
Johnson Manufacturing Co., Albion, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony & Fraley Sts., Philadelphia 35, Penna.
Ty-Sa-Man Machine Co., Inc., 1093 White Ave., Knoxville, Tenn.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

**CUTTING TOOLS**—See Tool Material

**CYLINDERS, Air**
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Mch. Co., Inc., Logansport, Ind.
Skinner Chuck Co., 95 Edgewood Ave., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.

**CYLINDERS, Hydraulic**
Barnes, John S., Corp., 301 S. Water St., Rockford, Ill.
Chicago Pneumatic Tool Co., New York 17, N. Y.
Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers, Inc., Detroit 32, Mich.

**DEBURRING MACHINES**
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland 14, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Wallace Supplies Mfg. Co., 1310 W. Diversey Parkway, Chicago 14, Ill.

**DEMAGNETIZERS**
Blanchard Mch. Co., 64 State St., Cambridge, Mass.

**DIE CASTINGS**—See Casting, Die

**DIE CASTING MACHINES**
Hydraulic Press Mfg. Co., Mount Gilead, Ohio

**DIE CUSHIONS**
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Minster Machine Co., Minster, Ohio.
Verson Allsteel Press Co., 93rd St., and S Kenwood Ave., Chicago, Ill.

**DIE INSERTS, Carbide**
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Kennametal, Inc., Latrobe, Penna.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Vascoloy-Ramet Corp., Waukegan, Ill.

**DIE SETS AND DIEMAKERS' SUPPLIES**
Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Lempco Industrial, Inc., Bedford, Ohio
Producto Mch. Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Wales-Strippit, Inc., Akron, N. Y.

**DIE SINKING MACHINES**—See Milling Machines, Die Sinking, etc.

**DIE STOCKS**—See Stocks and Dies


1. Bronze Bearing, with self-adjusting "U" Cup Piston Rod Seal for longer wear.
2. Rod Wiper protects Piston Rod Seal and keeps Cylinder clean.
3. "U" Cup Seals expand with pressure to provide positive seal with minimum friction.
4. Wrench Flats make for easy installation.
5. Ground, hard chrome-plated Piston Rods have minimum yield strength of 125,000 psi.
6. Self-locking cushion adjusting screw and ball check are below surface for protection . . . easily accessible.
7. For extra strength, Cylinder Ends and Mounting Plates are machined from bar stock and steel forgings.
8. Cylinder is precision-finished brass for extra heavy duty.
9. Variety of mountings can be interchanged—easily match any installation requirement.
10. Interchangeable with all JIC Cylinders.

# SCHRADER SQUARE-END CYLINDERS

## meet and exceed JIC specs . . . 250 psi air . . . 750 psi hydraulic!

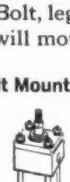
Here's compact, versatile straight-line power. Just look at the features!

Use Schrader's new square-end double-acting cylinders for holding, positioning, moving work—for push, pull or lifting—for automating manual operations. In five sizes up to 4-inch bore, and with five interchangeable mountings, these "square-ends" are economical and versatile. Bolt, leg, flush, side flush or base . . . each JIC Cylinder will mount all five ways. Suitable for air pressures to 250 psi, or hydraulically to 750 psi—available cushioned or non-cushioned.

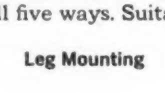
You get safe, controlled, low-cost power with Schrader "square-ends"—another addition to the line of famous Schrader quality Air Control Products.

Complete stocks available locally—expert help to improve your air control hookups. Write for your complete specifications and data on these new "square-ends."

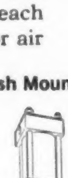
**Bolt Mounting**



**Leg Mounting**

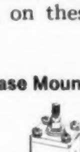


**Flush Mounting**



**Side-Flush Mounting**

**Base Mounting**



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*a division of* SCOVILL

**A. SCHRADER'S SON**
***Division of Scovill Manufacturing Co.***
**454 Vanderbilt Avenue, Brooklyn 38, N. Y.**

QUALITY AIR CONTROL PRODUCTS

**DIES, Blanking, Forming, Drawing, Extruding, etc.**
Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport 7, Conn.
Niagara Mch. & Tool Wks., 637 Northland Ave., Buffalo 11, N. Y.
Olofsson Corp., Lansing, Mich.
Ryerson & Son, Inc., Jos. T., 16th & Rockwell St., Chicago 8, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.
Verson Allsteel Press Co., 93rd St., and S. Kenwood Ave., Chicago, Ill.
Wales-Strippit, Inc., Akron, N. Y.

**DIES, Lettering and Embossing**
Wales-Strippit, Inc., Akron, N. Y.

**DIES, Self-opening Threading**
Consolidated Mch. Tool Div., 565 Blossom Rd., Rochester 10, N. Y.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

**DIES, Thread Cutting**—See Stocks and Dies

**DIES, Thread Rolling**
Landis Machine Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.

**DISINTEGRATORS**
Cincinnati Milling & Grinding Mchs. Inc., Cincinnati 9, Ohio.
Casa Corp., 405 Lexington Ave., New York 17, N. Y.

**DIVIDERS AND TRAMMELS**—See Layout and Drafting Tools

**DIVIDING HEADS**—See Indexing and Spacing Equipment

**DOWEL PINS**
Allen Mfg. Co., Bloomfield, Conn.
Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
DoALL Co., Des Plaines, Ill.
Producto Machine Co., 985 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

**DRAWING COMPOUNDS**
Oakite Products Inc., 26 Rector St., New York 6, N. Y.

**DRESSERS, Grinding Wheel**
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Metal Carbides Corp., Youngstown, Ohio.
Metallurgical Products Dept. of General Electric Co. Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield St., Dayton 1, Ohio.

**DRIFT KEYS**
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
DoALL Co., Des Plaines, Ill.

**DRILL HEADS, Multiple Spindle**

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 387 Homestead Ave., Hartford, Conn.
Jarvis Corp., Middletown, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Richmond, Ind.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**DRILL HEADS, Unit Type**

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., Pittsburgh, Pa.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford 12, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Snow Manufacturing Co., Bellwood, Illinois.

**DRILL SLEEVES AND EXTENSION HOLDERS**

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Automatic Tool Co., Inc., S. 7th & N Sts., Richmond, Ind.

**DRILLING ATTACHMENTS,** Multiple Spindle—See Drill Heads, Multiple Spindle, and Vises, Machine

**DRILLING AND BORING UNITS, Self-contained**

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Watson Ave., Springfield, Mass.
Buhr Machine Tool Co., 839 Green St., Ann Arbor, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Ettco Tool Co. Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Russell Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Townsend, H. P. Mfg. Co., Elmwood, Conn.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**DRILLING MACHINES, Automatic**

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes W F & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.

Cross Co., P. O. Box 3835, Park Grove Postal Sta.. Detroit 5, Mich.
Davis & Thompson Co., 4460 N. 12th St., Milwaukee 10, Wis.
Edlund Mchry. Co., Div., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Olofsson Corp., Lansing, Mich.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit, Inc., Akron, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

### DRILLING MACHINES, Bench

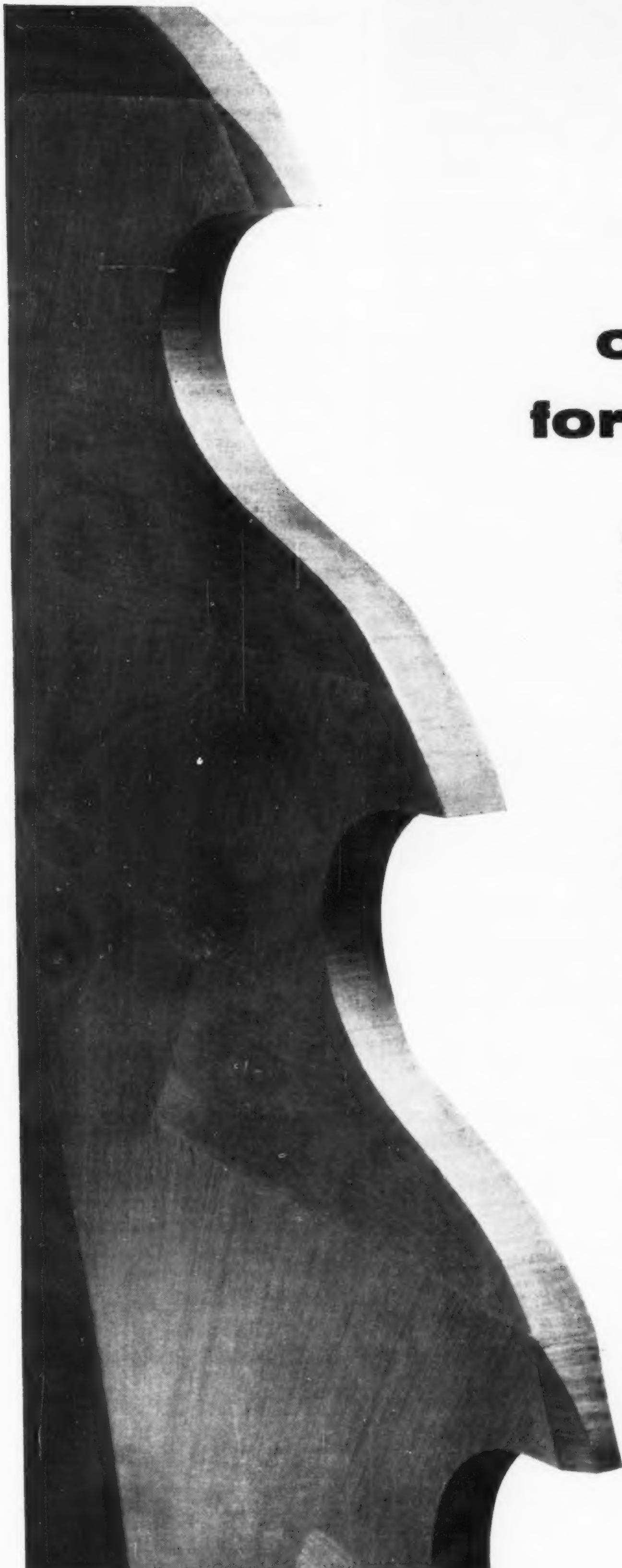
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 9th St., Hamilton, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester. Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.

### DRILLING MACHINES, Deep Hole

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Berthiez, Charles, 5 Rue Montalivet, Paris, France
Burg Tool and Mfg. Co., Inc., :5001 S. Figueroa, Gardena, Calif.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Leland-Gifford Co., Box 989, Worcester 1, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wales-Strippit, Inc., Akron, N. Y.

### DRILLING MACHINES, Gang, Multiple-spindle

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F & John Co., Rockford, Ill.
Baush Machine Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Bunr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 4460 124th St., Milwaukee 10, Wis.
Edlund Machinery Co., Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 136 12th St., Rockford, Ill.
Hamilton Tool Co., 834 So. 9th St., Hamilton, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., Box 989, Worcester. Mass.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Moline Tool Co., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.



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**Cutting Tool Manufacturing Division**
**Cleveland 17, Ohio**



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### DRILLING MACHINES, Radial

American Tool Works Co., Pearl & Eggleston Ave., Cincinnati, Ohio.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Russell, Holbrook Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

### DRILLING MACHINES, Sensitive

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Cincinnati 9, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Edlund Machinery Co. Div., Cortland, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, St., Cincinnati 23, Ohio.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Leland-Gifford Co., Box 989, Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Manufacturing Co., Bellwood, Illinois.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Wales-Strippit, Inc., Akron, N. Y.

### DRILLING MACHINES, Universal Radial

Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.

### DRILLING MACHINES, Upright

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Barnes, W. F. & John Co., Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Cincinnati Bickford Div., Oakley, Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Machinery Co., 287 Homestead Ave. Hartford, Conn.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Manufacturing Co., Bellwood, Ill.
Wales-Strippit, Inc., Akron, N. Y.

### DRILLS, Center

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Circular Tool Co., Inc., 765 Allens Ave., Providence 5, R. I.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Cogsdill Twist Drill Co., Greenfield, Mass.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Threadwell Tap & Die Co., 16 Arch St., Greenfield, Mass.

### DRILLS, Core

Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Metallurgical Products Dept. of General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Mohawk Tools, Inc., Montpelier, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

*A 3M Case History Report*

POLISHING

# STEEL POLISHING SPEEDED 10–15% WITH "PG" WHEELS

**MANUFACTURER:** Heintz Division of Kelsey-Hayes Co.
**ADDRESS:** Philadelphia, Pennsylvania.
**PRODUCT MANUFACTURED:** Automotive Metal Stampings.
**3M ABRASIVE USED:** "PG" Wheels.

**HOW 3M ABRASIVES ARE USED:** Finishing operation. Remove die marks, scratches, and other forming defects from cold-rolled carbon steel auto grille bars, prior to plating.

**OPERATIONAL DATA ON 3M METHOD:** Grit 220 Resin Bond Cloth "PG" Wheel on double-spindle floor lathe with buff-wheel.

**OPERATIONAL DATA ON PREVIOUS METHOD:** 2-station, 3-step method. 1st, #120 disc; 2nd, set-up wheel; 3rd, buff-wheel.

**PROVEN ADVANTAGES OF 3M METHOD:** Former 3-step operation reduced to 2 steps; "PG" Wheel and Buff. "PG" Wheel leaves no scratches on work piece; speeds production 10-15%.

**OTHER 3M ABRASIVE PRODUCTS IN USE:** "Three-M-ite" Resin Bond Cloth Portable "PG" Wheels on hand-grinders are used to remove in-use scratches, other imperfections from dies, without removing them from press. "PG" Wheels replaced hand methods, reduced repair time from 14 hours to 30 minutes.

**WANT MORE INFORMATION?** Send for free manual, "Modern Metal Finishing with 3M 'PG' Wheels." Write to 3M Co., St. Paul 6, Minn., Dept. TV-49.

"PG" Wheels are manufactured in U.S.A by 3M Company, St. Paul 6, Minn. Export: 99 Park Avenue, New York. Canada: London, Ontario

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## 3M Coated Abrasives
**"PG" WHEELS**

**MINNESOTA MINING AND MANUFACTURING COMPANY**
...WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

**DRILLS, Deep Hole, Gun**
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.

**DRILLS, Oil Hole, Oil Tube**
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.

**DRILLS, Portable Electric**
Chicago Pneumatic Tool Co., New York 17, N. Y.

**DRILLS, Portable pneumatic**
Chicago Pneumatic Tool Co., New York 17, N. Y.

**DRILLS, Ratchet**
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.

**DRILLS, Subland**
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Mohawk Tools, Inc., Montpelier, Ohio



**DRILLS, Twist, High-Speed Steel, Carbon Steel**
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Mohawk Tools, Inc., Montpelier, Ohio
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

**DRILLS, Twist, Carbide, Carbide-Tipped**
Allegheny Ludlum Steel Corp., Oliver Bldg., Pittsburgh 22, Pa.
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoAll Co., Des Plaines, Ill.
Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.

**DRILLS, Wire**
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., Cleveland, Ohio.
Cogsdill Twist Drill Co., Greenfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
National Twist Drill & Tool Co., Rochester, Mich.

**DUPLICATING ATTACHMENTS**—See Tracing Attachments

**DUST COLLECTORS AND CONTROL SYSTEMS**
Brown & Sharpe Mfg. Co., Providence, R. I.
Pangborn Corp., Hagerstown, Md.
Standard Electrical Tool Co., 2500 River Rd., Cincinnati 14, Ohio.

**ELECTRICAL DISCHARGE MACHINES** —See Distintegrators

**ELECTRONIC CONTROL SYSTEMS**
Micro-Path Inc., Ingelwood 2, Calif.

**ENGRAVING MACHINES**
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, Geo., Mach., 1321 Racine St., Racine, Wis.

**EXTRACTORS, Screw**
Chicago-Latrobe, 411 W. Ontario St., Chicago 10, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**FACING HEADS**
Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kaukauna Machine & Foundry Div., Giddings & Lewis Machine Tool Co., Kaukauna, Wis.
Mummert-Dixon Co., Hanover, Pa.

**FANS, Exhaust, Ventilating**
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.

**FASTENERS**
Allen Mfg. Co., Bloomfield, Conn.
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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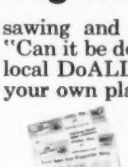

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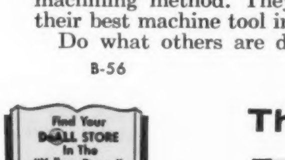


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**FEEDERS, Automatic**
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
V & O Press Co., Hudson, New York

**FILES, Band**
DoAll Co., Des Plaines, Ill.

**FILES, General-purpose, Swiss Pattern**
DoAll Co., Des Plaines, Ill.

**FILES AND BURRS, Rotary**
DoAll Co., Des Plaines, Ill.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

**FILING MACHINES**
Chicago Pneumatic Tool Co., New York 17, N. Y.
DoAll Co., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

**FILTERS, Coolant and Oil**
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Marvel Engineering Co., 7227 N. Hamlin Ave., Chicago 45, Ill.

**FLAME-HARDENING MACHINES**
Cincinnati Milling and Grinding Mchs., Inc., Cincinnati 9, Ohio
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

**FORGING HAMMERS, Steam and Air**
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.

**FORGING MACHINES, Headers, Upsetters, Presses**
Ajax Mfg. Co., 1441 Chardon Rd., Cleveland 17, Ohio
Bliss, E. W. Co., 1375 Raff Rd. S. W. Canton, Ohio
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
National Machinery Co., Tiffin, Ohio
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

**FORGING, Hollow-Bored**
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.

**FORGINGS, Drop**
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Mueller Brass Co., Port Huron 35, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**FORGINGS, Press**
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., Cleveland 14, Ohio
Minster Mch. Co., Minster, Ohio
Mueller Brass Co., Port Huron 35, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y. (die-pressed)
Vanadium-Alloys Steel Co., Latrobe, Penna.

**FORGINGS, Upset**
Bethlehem Steel Co., 701 East Third St., Bethlehem, Pa.
Vanadium-Alloys Steel Co., Latrobe, Penna.

**FORMING MACHINES, Cold-Rolling**
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Niagara Mch. & Tool Works, 637 Northland Ave., Buffalo, N. Y.
Yoder Co., 5500 Walworth, Cleveland, Ohio

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A new MARVEL invention—the "Sure-Line" Automatic Blade Controller—*at last* attacks the problem of maintaining accuracy in high speed band sawing.

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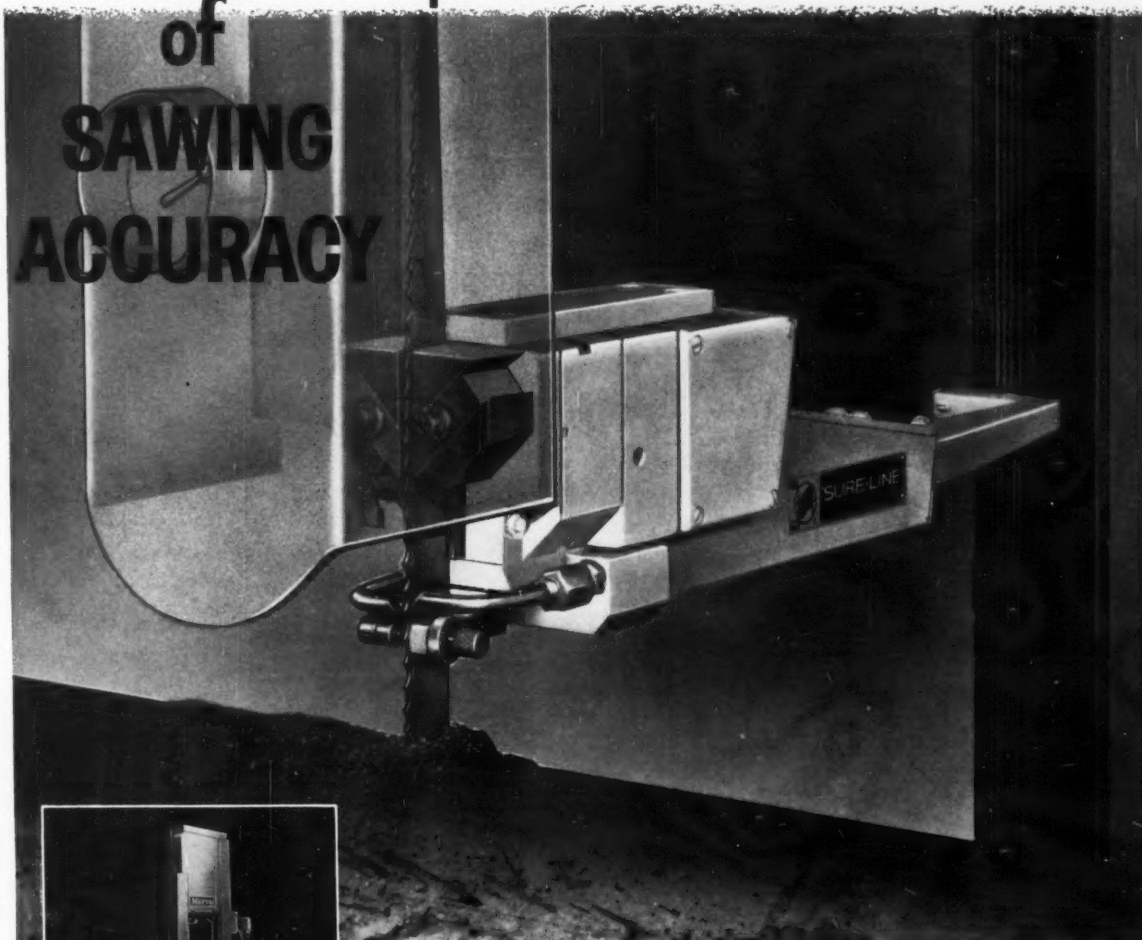


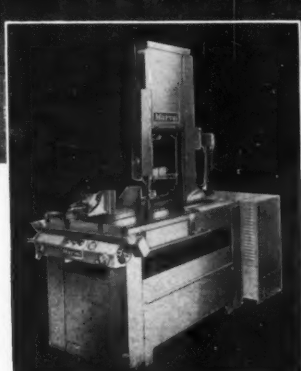

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Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

**GAGES, Air Comparator**

Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Pratt & Whitney Co., Inc., West Hartford, Conn.
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Sheffield Corp., Box 893, Dayton 1, Ohio

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Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
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DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S. Co., Athol, Mass.

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Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.
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Threadwell Tap & Die Co., 16 Arch, Greenfield, Mass.
Van Keuren Co., 176 Waltham St., Watertown 72, Mass.
Winter Bros. Co., Rochester, Mich.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5. Mich.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
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Sheffield Corp., Box 893, Dayton 1, Ohio

**GEAR CHECKING EQUIPMENT**
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Fellows Gear Shaper Co., Springfield, Vt.
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Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Scherr, George Co., Inc., 200 Lafayette St., New York 12, N. Y.

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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
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Barber-Colman Co., 1300 Rock St., Rockford, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
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Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio
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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

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**GEAR LAPPERS**
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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
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National Broach & Mch. Co., 5600 St. Jean, Detroit 12, Mich.

**GEAR MOTORS**—See Speed Reducers

**GEAR RACKS**
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Stahl Gear & Mch. Co., The, 3901 Hamilton Ave., Cleveland 4, Ohio

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Fellows Gear Shaper Co., Springfield, Vt.
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Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio
Diefendorf Gear Corp., Box 934, Syracuse, N. Y.
Greaves Machine Tool Co., 2011 Eastern Ave., Cincinnati, Ohio
New Jersey Gear & Mfg. Co., Hillside, N. J.
Ryerson, Jos. T. & Son, Inc., 16th and Rockwell St., Chicago 8, Ill.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio

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Boston Gear Works, 14 Hayward St., Quincy 71, Mass.
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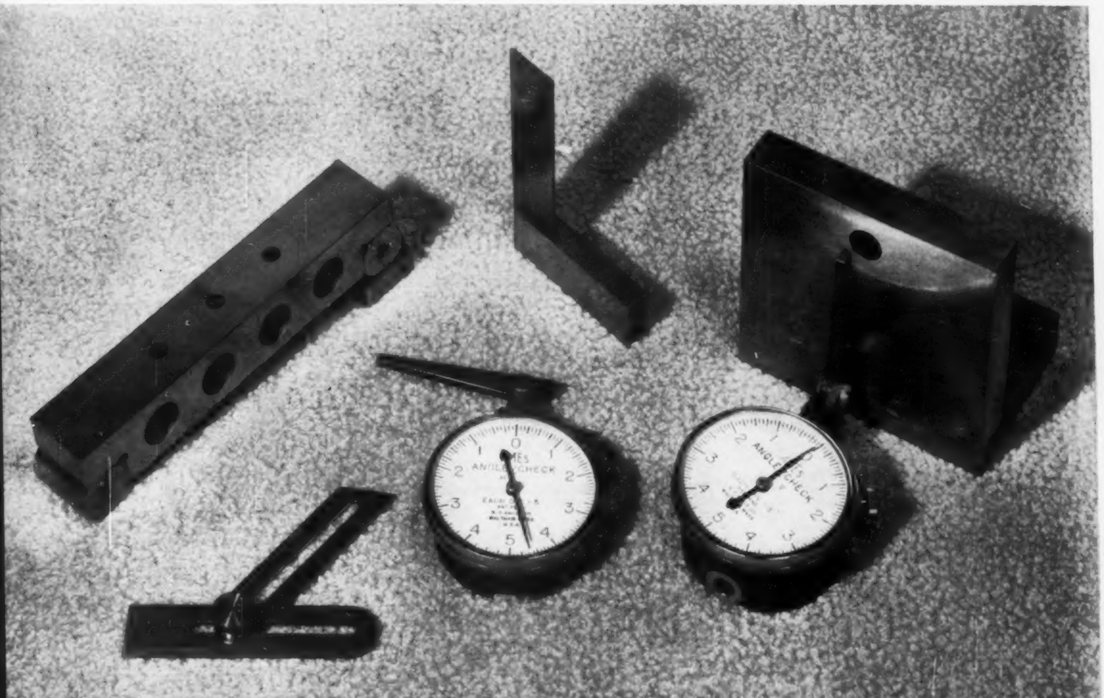

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Hammond Machinery Builders, Inc., Kalamazoo, Mich.
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Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
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Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
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Landis Tool Co., Waynesboro, Pa.
LeBlond, R. K., Mch. Tool Co. Madison and Edwards Rds., Cincinnati 18, Ohio
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati, Ohio

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Thompson Grinder, 1534 W. Main, Springfield, Ohio

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Norton Co., 1 New Bond St., Worcester 6, Mass.
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Landis Tool Co., Inc., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
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Standard Electrical Tool Co., 2500 River Rd., Cincinnati 4, Ohio
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Sheffield Corp., Box 893, Dayton 1, Ohio

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Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
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Standard Electrical Tool Co. 2488-90 River Rd., Cincinnati, Ohio.
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Wicaco Machine Corp., Wayne Junction, Philadelphia, Pa.

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Fosdick Mch. Tool Co., 1638 Blue Rock St., Cincinnati 23, Ohio
Gallmeyer & Livingston Co., 336 Straight S.W., Grand Rapids 2, Mich.
Moore Special Tool Co., Inc., 740 Union Ave., Bridgeport, Conn.

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Gallmeyer & Livington Co. 336 Straight, S.W. Grand Rapids 4, Wis.
Gardner Machine Co., Beloit, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
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Gardner Machine Co., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Mattison Machine Works, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland 8, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
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Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
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Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sheffield Corp., Box 893, Dayton 1, Ohio

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Gallmeyer & Livingston Co., 336 Straight, S.W., Grand Rapids 2, Mch.
Gorton Mch. Co., Geo., 1321 Racine St., Racine, Wis.
Jones & Lamson Mch. Co., Springfield, Vt.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
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Sheffield Corp., Box 893, Dayton 1, Ohio

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Gardner Machine Co., Beloit, Wis.
Macklin Co., Jackson, Mich.
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Navan Products Inc., 900 N. Sepulveda Blvd., Los Angeles 45, Calif.
Norton Co., 1 New Bond St., Worcester 6, Mass.

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Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

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### HOISTS, Electric

Shepard Niles Crane & Hoist Corp., Montour Falls, N. Y.

### HONING MACHINES

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Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
Moline Tool Co., 102-120th St., Moline, Ill.
Superior Hone Corp., 1623 Elreno St., Elkhart, Inc.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

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Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
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Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.

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Bliss, E. W., Co., 1375 Raff Rd., E. W. Canton, Ohio
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., Erie, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Michigan Drill Head Co., Detroit 34, Mich.
Modern Ind. Engrg. Co., 14230 Birwood Ave., Detroit 4, Mich.
Northern Hydraulics & Mch. Corp., Melrose Park Ill.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.
Vickers Incorporated, Div. of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.
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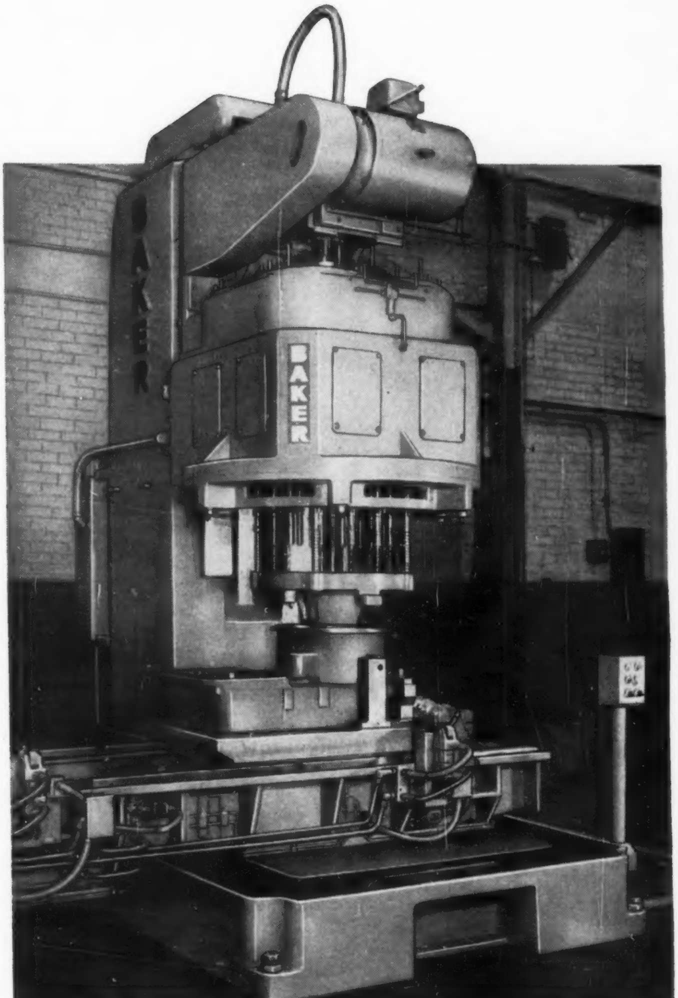
# A special machine job done by a STANDARD

# BAKER®

## ADJUSTABLE SPINDLE MACHINE




Baker A-24-VU Adjustable Spindle Machine with standard 36" round universal head and standard slip plate bored for 46 spindles.

An automotive contractor's production did not allow for a special machine to work on heavy, hard-to-handle truck transmission housings. Conscious also of retooling costs, the contractor took his problem to the BAKER engineers.

THE RESULT: This A-24-VU Standard Adjustable Spindle Machine, with a few special adaptations. Only accessories added: slip plate, bushing plate and transfer, including pallet.

The work piece is held on a pallet which transfers it from prior operations where the top flange of the housing is completely machined. The BAKER drills 2 sets of bolt circle holes on the top flange and 1 set at the housing bottom. A bushing plate, supported on the slip spindle plate, guides the drills and targets into bushings on the pallet for positive location.

Using this BAKER Standard, the contractor saved special machine costs, gained the high production needed and found it simple to take the BAKER out of the transfer line and use it for other drilling and tapping operations.

**For the complete story on how Baker Standard Adjustable Spindle Machines can solve your special production problems, write Baker Brothers, Inc., 1000 Post Street, Dept. MH-459, Toledo 10, Ohio.**

*THIS IS REAL Flexibility*

## NOW . . . COMPLETELY INTERCHANGEABLE

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| TO FIT 3 SIZES VERTICAL MACHINES | 21 ADJUSTABLE SPINDLE HEADS<br>27 FIXED SPINDLE HEADS<br>3 TYPES STANDARD TABLES | TO FIT 3 SIZES HORIZONTAL MACHINES |

# BAKER®

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Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Opto-Metric Tools, Inc., 137 Varick St., New York, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

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Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, L. S. Co., Athol, Mass.

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Brown & Sharpe Co., Providence, R. I.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
National Automatic Tool Co., S. 7th - N. Sts., Richmond, Ind.
Starrett, The L. S. Co., Athol, Mass.

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Brown & Sharpe Mfg. Co., Providence, R. I.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Starrett The L. S., Co., Athol, Mass.

**INDICATORS, Test**
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Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Starrett, The L. S., Co., Athol, Mass.

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Columbus Die Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio
Hartford Special Mchry. Co., 287 Homestead Ave., Hartford, Conn.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
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Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Crane Packing Co., 6400 Oakton St., Morton Grove, Ill.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gleason Works, 1000 University Ave., Rochester, N. Y.
Micromatic Hone Corp., 8100 Schoolcraft Ave., Detroit 38, Mich.
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Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Sheldon Mch. Co., Inc., 4258 N. Knox Ave., Chicago 41, Ill.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

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Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Il.

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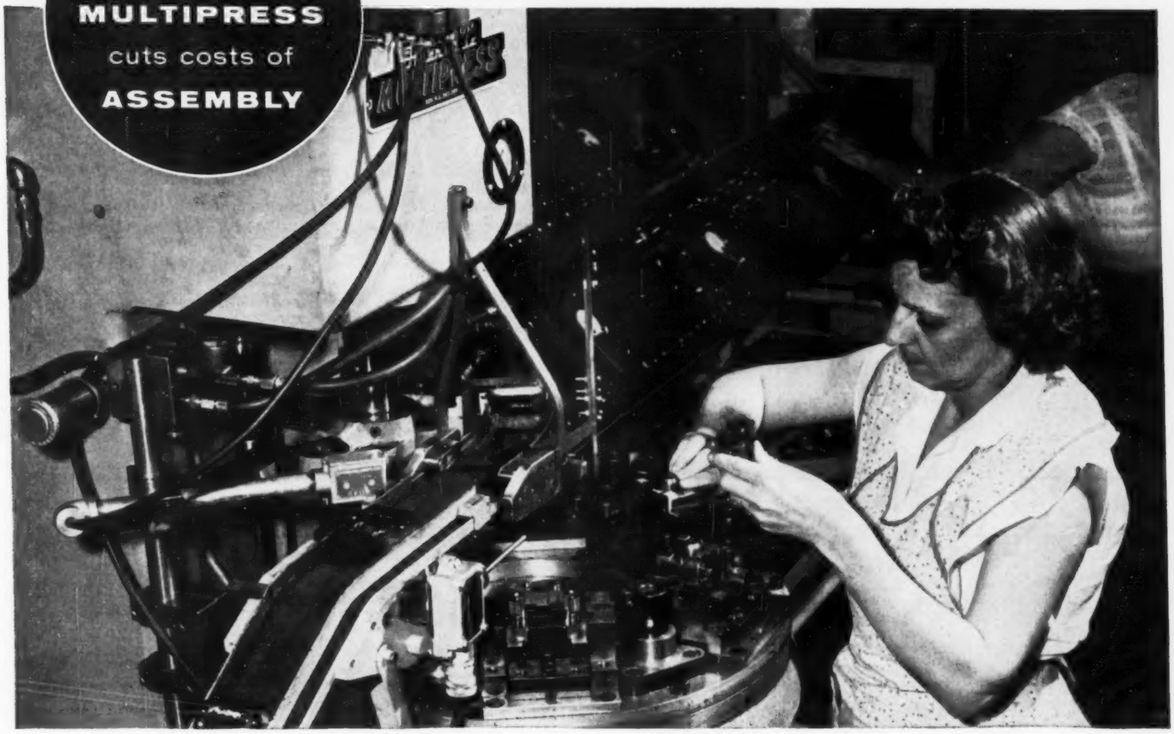
How
**DENISON**
**MULTIPRESS**
cuts costs of
**ASSEMBLY**

**ONE OF THREE,** *this Denison 4-ton hydraulic Multipress is equipped with 6-station automatic index table to assemble both halves of lamination stacks of small electric motors.*



# Savings with **DENISON** Multipress justify MAPI replacement recommendations at **BARBER-COLMAN**

## *...line of 3 new hydraulic presses simplifies and speeds small motor assemblies*

Installed upon recommendation of a MAPI replacement analysis, three Denison hydraulic Multipresses are today meeting predicted cost reductions in assembly operations at Barber-Colman Company, Rockford, Illinois.

Operating in a line and connected by conveyor belts, these three hydraulic presses handle—on a semi-automatic basis—such operations as bending, staking, aligning, compressing, riveting and stamping in the production and assembly of small electric motors.

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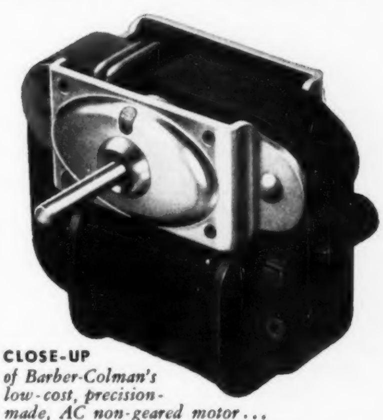
Savings in cost and uniform production like this can be duplicated in your shop today. A cost reduction study by a Denison Specialist in press work can show you how. Write today for a descriptive catalog on the complete Multipress line.



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*of Barber-Colman's low-cost, precision-made, AC non-geared motor... assembled by Denison Multipresses.*

**DENISON ENGINEERING DIVISION**
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For more data, circle this page number on inquiry card

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Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio

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**LATHES, Crankshaft**

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Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

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Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Sidney Machine Tool Co., Sidney, Ohio

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Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Hendey Mch. Div., Barber Colman Co., Rockford, Ill.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.

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Cincinnati Lathe & Tool Co., 3207 Disney St., Cincinnati 9, Ohio
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Hardinge Bros. Inc., 1420 College Ave., Elmira, N. Y.
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LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerai Ave., Cincinnati 25, Ohio
Logan Engineering Co., 4901 Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio
Orban Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
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LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio

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South Bend Lathe Works Inc., 425 E. Madison St., South Bend, Ind.

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Monarch Mch. Tool Co., Oak St., Sidney, Ohio
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City, 2, N. J.

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Monarch Mch. Tool Co., Oak St., Sidney, Ohio
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Hardinge Brothers, Inc., 1420 College Ave., Elmira, N. Y.
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*(Continued on page 286)*

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Gorton, George Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio
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Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Pratt & Whitney Co., Inc., West Hartford, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
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Cincinnati Milling & Grinding Mches., Inc., 470 Marburg Ave., Cincinnati 9, Ohio
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Espen-Lucas Mch. Wrks., Front St., and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Motch & Merryweather Mchy. Co., 888 E. 70th St., Cleveland 3, Ohio
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

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Nichols, W. H. Co., Waltham 54, Mass.

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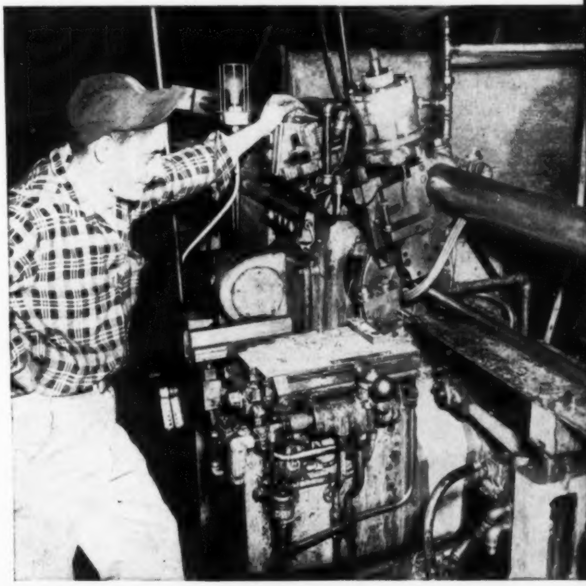
# "Flexible Automation"

## WITH BARDONS & OLIVER CUTTING-OFF LATHES

at Falls Steel Tube & Manufacturing Co., Newton Falls, Ohio

At Falls Steel Tube & Mfg. Co., manufacturers of exhaust pipes, tail pipes, and similar automotive tubular parts, the output of two electric weld tube mills is automatically transferred to three Bardons & Oliver loading tables. The tubing is then fed into three Bardons & Oliver Cutting-Off Lathes and automatically cut off in any required length from 6 inches to 10 feet. The cutoff lengths are automatically unloaded into tote trucks. Besides wide variance in length, tubing diameters vary from ½ to 3 inches and wall thickness from 14 to 20 gauge.



Victor Beltram, Chief Engineer, reports labor reduced by 75% and cutoff capacity increased by 50% with the Bardons & Oliver installation. Previously, cutoff operations were performed on circular sawing machines. The cutting-off lathes produce square ends and smooth finishes which have greatly facilitated secondary operations. The increased cutoff capacity has allowed greater utilization of all plant facilities. The complete Bardons & Oliver installation has paid for itself in less than three years.

If you cut off spacers, bushings, nipples, couplings, rollers, similar tubular products, or solid bar stock, we suggest you explore the profit possibility offered by these versatile machines. Bardons & Oliver manufactures a complete line of Cutting-Off Lathes ranging in collet capacity from 2 to 16 inches.

**BARDONS & OLIVER**

BARDONS & OLIVER, INC., 1135 WEST 9th ST., CLEVELAND 13, OHIO

Manufacturers of Turret Lathes and Cutting-Off Lathes

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Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Nichols, W. H. Co., Waltham 54, Mass.
Olivetti Corp. of America, 42-33 Northern Blvd., Long Island City 1, N. Y.
Snyder Tool & Engrg. C., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2351 11th St., Rockford, Ill.

**MILLING MACHINES, Die Sinking, Duplicating, Profiling**

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Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

**MILLING MACHINES, Knee Type, Horizontal, Plain, Universal**

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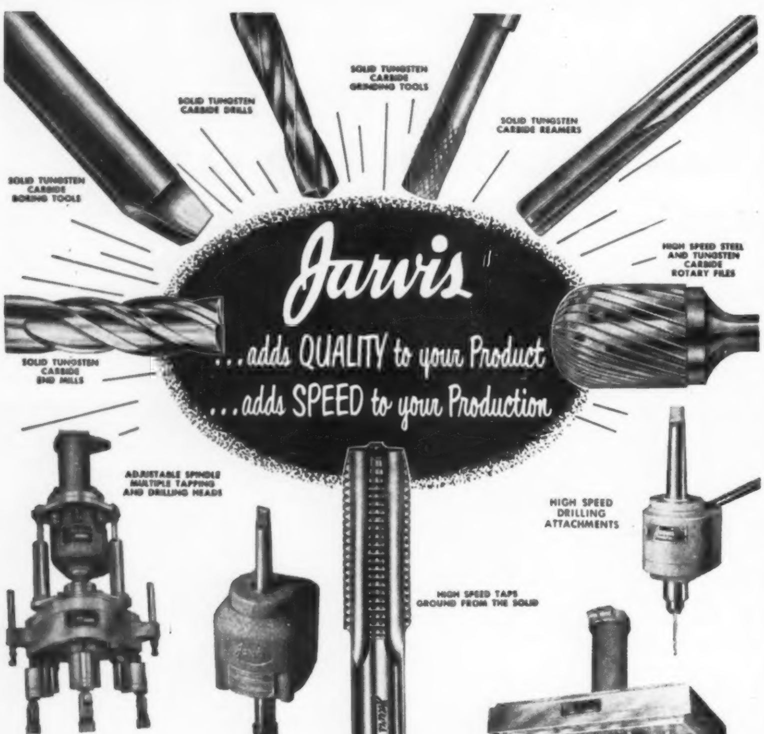
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton Geo., Mch., Co., 1110 W. 13th St., Racine, Wis.
Greaves Machine Tool Div., 2009 Eastern Ave., Cincinnati, Ohio
Hardinge Bros., Inc., 1420 College Ave., Elmira, N. Y.
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.




**MILLING MACHINES, Knee Type Rise and Fall**

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., 42 Exchange Place, Jersey City, N. J.

**MILLING MACHINES, Knee Type Ram**

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
Gorton Mch. Co., 1321 Racine St., Racine Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Van Norman Machine Co., 3640 Main St., Springfield 7, Mass.

**MILLING MACHINES, Knee Type Turret**

Gorton Mch. Co., 1321 Racine St., Racine, Wis.

**MILLING MACHINES, Knee Type, Vertical**

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Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc. 4701 Marburg Ave., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cosa Corp., 450 Lexington Ave., New York 17 N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Nichols, W. H. Co., Waltham 54, Mass.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.

**MILLING MACHINES, Planer Type**

Berthiez, Charles, 5 Rue Montalivet, Paris,
Consolidated Mch. Tool Div., Blossom Road, Rochester 10, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R.R., Evanston, Cincinnati, Ohio
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Ingersoll Milling Mche. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Orban, Kurt Co., Inc., 42 Exchange Place, Jersey City 2, N. J.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

**MILLING MACHINES, Spar**

Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
G & L and Hypro Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

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Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hydraulic Press Mfg. Co., Mount Gilead, Ohic

**MOTORS, Air**

Ingersoll-Rand Co., Phillipsburg, N. J.

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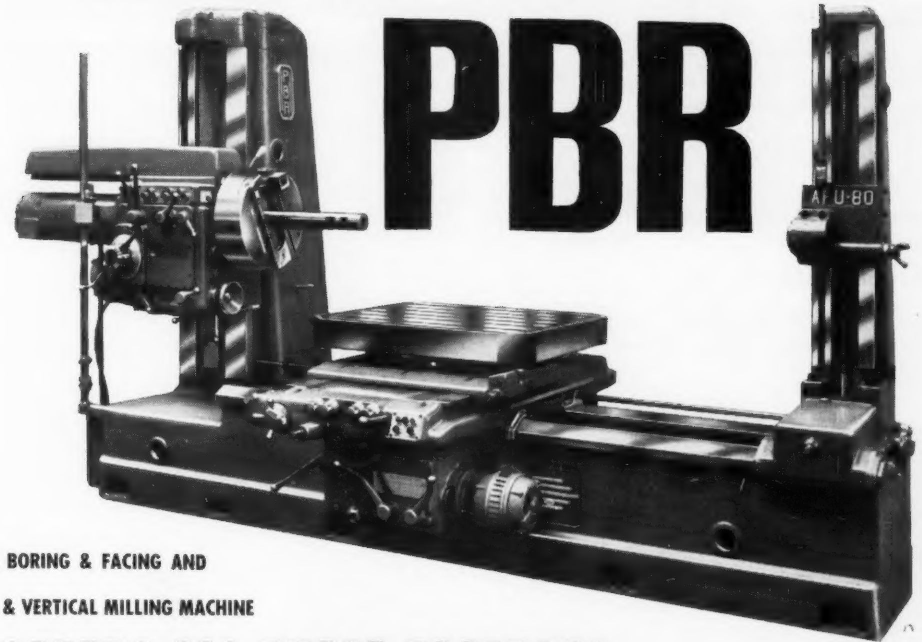
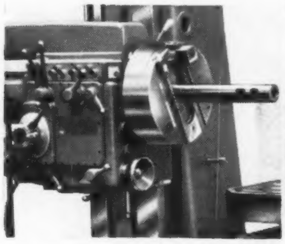


**HORIZONTAL BORING & FACING AND**

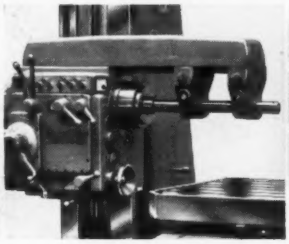
**HORIZONTAL & VERTICAL MILLING MACHINE**

## OFFERS ALL THESE FEATURES:



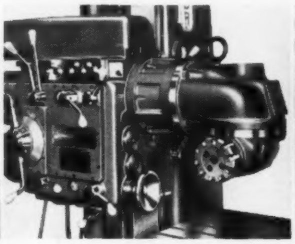
**HORIZONTAL BORING & FACING**

- Nitrided alloy steel spindle 3⅛ in. dia.
- Detachable facing head 17¾ in. dia.
- To face and edge up to 25 in. dia.
- Facing head speeds 35 to 185 r.p.m.
- Spindle speeds 35 to 1200 r.p.m.
- Bore of spindle No. 5 Morse
- Traverse of spindle 24 in.
- Distance facing head to outer bearing 91½ in.



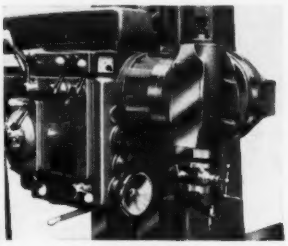
**HORIZONTAL MILLING WITH OVERARM**

- Max. Cutter dia. 12 in.
- Max. arbor length 24 in.
- Arbors supplied 1¼ in. and 1½ in. dia.
- Spindle speeds 35 to 1.200 r.p.m.
- Size of table 39⅜ in. x 34½ in.
- Longitudinal traverse 51 in.
- Table cross traverse 32 in.
- Max distance spindle to table 35 in.
- 12 feeds in all directions ⅜ in. to 14 in. per min.



**UNIVERSAL ALL-ANGLE FACE MILLING**

- Universal head swivels on two axes 360 deg.
- Maximum height spindle nose to table 27 in.
- Depth of throat 14 in.
- Taper in spindle nose 40 N.S.
- Spindle speeds 35 to 1200 r.p.m.



**AUTOMATIC FACING AT ANY ANGLE**

using the 'D'Andrea' Facing Attachment (extra)

- Size of attachment normally fitted: T.R.2
- Maximum facing dia. 12 in.
- Maximum traverse to slide 2 in.
- Fine auto feed per rev. 0.0025 in.
- Coarse auto feed per rev. 0.0075 in.
- Max. depth of cut ⅛ in.
- Max. boring depth 7 in.

* **VEE-FLAT SLIDEWAY BED, Built-in coolant tank. 91 1/2" spindle to stay**

* **HEAVY TABLE with suds channel surround 39 3/8" x 34"**

* **ALL-ANGLE UNIVERSAL MILLING HEAD. No. 40 N.S. Spindle**

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Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Vickers, Inc., Detroit 32, Mich.

**MULTIPLE INSPECTION GAGES**—See Gages, Multiple Inspection

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Baush Mch. Tool Co., 15 Wason Ave., Springfield, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Federal Products Corp., 1144 Eddy St., Providence 1, R. I.
Greenlee Bros. & Co., 2136 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
National Automatic Tool Co., S. 7th N. St. Richmond, Ind.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 - 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill


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Buhr Mch. Tool Co., 839 Green St., Ann Arbor, Mich.
Bullard Co., Bridgeport 6, Conn.
Cincinnati Milling Mch. Co., Cincinnati 9, Ohio
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Davis & Thompson Co., 4460 N. 124th St., Milwaukee 10, Wis.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Greenlee Bros. & Co., 2136 - 12th St., Rockford, Ill.
Hartford Special Machinery Co., 287 Homestead Ave., Hartford Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kearney & Trecker Corp., 6784 W. National, Milwaukee 14, Wis.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Moline Tool Co., 102-20th St., Moline, Ill.
National Automatic Tool Co., S. 7th N. Sts., Richmond, Ind.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Snyder Corp., 3400 E. Lafayette Ave., Detroit 7, Mich.
Sundstrand Mch., Tool Co., 2531 11th St., Rockford, Ill.
Verson Allsteel Press Co., 9399 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

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Buckeye Tools Corp., Dayton, Ohio

**NIBBLING MACHINES**
Wales-Strippit, Inc., Akron, N. Y.

**NUT SETTERS**—See Screwdrivers, etc.

**NUTS**—See Bolts, Nuts and Screws

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Madison-Kipp Corp., Madison, Wis.
Wicaco Mch. Corp., Philadelphia, Pa.

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**OILS, Lubricating**—See Lubricating Oils and Greases

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Houghton, E. F. & Co., 303 W. Lehigh Ave., Philadelphia 33, Penna.
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DoALL Co., Des Plaines, Ill.
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Van Keuren Co., 176 Waltham St., Watertown 72, Mass.

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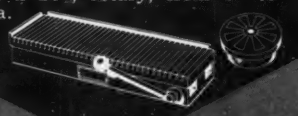
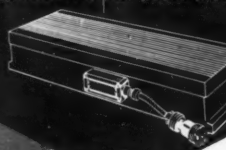
# World's largest, most complete line of permanent and electro-magnetic and vacuum chucks

Walker Chucks are designed and engineered to give efficient and completely dependable performance in all applications. The incomparable combination of structural and operating features makes Walker Chucks your best buy in every way.

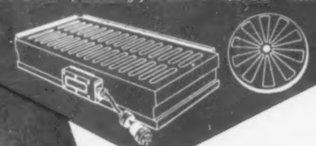
Walker permanent magnetic chucks utilize ceramic magnets which have *three times* the coercive force of alloy magnets. Rectangular chucks are available in 6 stock sizes, 6 x 10" to 12 x 24"; rotary, from 4" to 60" dia.



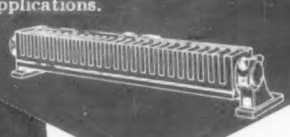
Small, thin work is easily handled with Walker bar pole electro-magnetic chucks. Rectangular in 81 sizes, from 6 x 12" to 30 x 96".



Holding jigs and fixtures are eliminated when you use Walker electro-magnetic chucks. Rectangular in 72 stock sizes, from 4 x 8" to 30 x 96"; rotary, from 6" to 36" dia.



In addition to the extensive range of stock sizes of permanent, electro-magnetic, and vacuum chucks and holding fixtures, Walker is your best source for "specials" for specfiic applications.

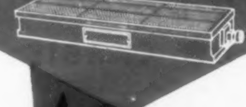


Walker has long been the leader in the field of demagnetizers. Stationary, hollow core demagnetizers are made to order in any size and shape of gap from 1" square up.

For complete information on the entire Walker line, write for Catalog No. 58.

O. S. WALKER COMPANY, INC.
WORCESTER 6, MASSACHUSETTS, U. S. A.

Walker vacuum chucks for holding non-ferrous parts are made to order in any desired size and shape. Favorites in the aircraft industry, they solve the problem of holding non-ferrous sheet stock. From 4" dia. to 10 ft. x 24 ft.



O.S. Walker

*O. S. Walker—The Original Designers and Builders of Magnetic Chucks!*

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Ryerson, Joseph T. & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

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Mueller Brass Co., 1925 Lapeer Ave., Port Huron, Mich.
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G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
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Hamilton Div., Baldwin-Lima-Hamilton Corp., Hamilton, Ohio
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Federal Press Co., 511 Division St., Elkhart, Ind.
Producto Machine Co., 985 Housatonic Ave., Bridgeport 1, Conn.
U. S. Tool Co., 255 N. 18th St., Ampere, East Orange, N. J.

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Logansport Machine Co., Inc., Logansport, Ind
Threadwell Tap & Die Corp., 16 Arch St., Greenfield, Mass.

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Bliss, E. W. Co., 1375 Raff Rd., S. W., Canton, Ohio
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Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Press Co., 511 Division St., Elkhart, Ind.
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Lake Erie Machinery Corp., 470 Woodward Ave., Buffalo 17, N. Y.
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Cleveland Punch & Shear Wks. Co., 3917 St. Clair Ave., Cleveland 14, Ohio
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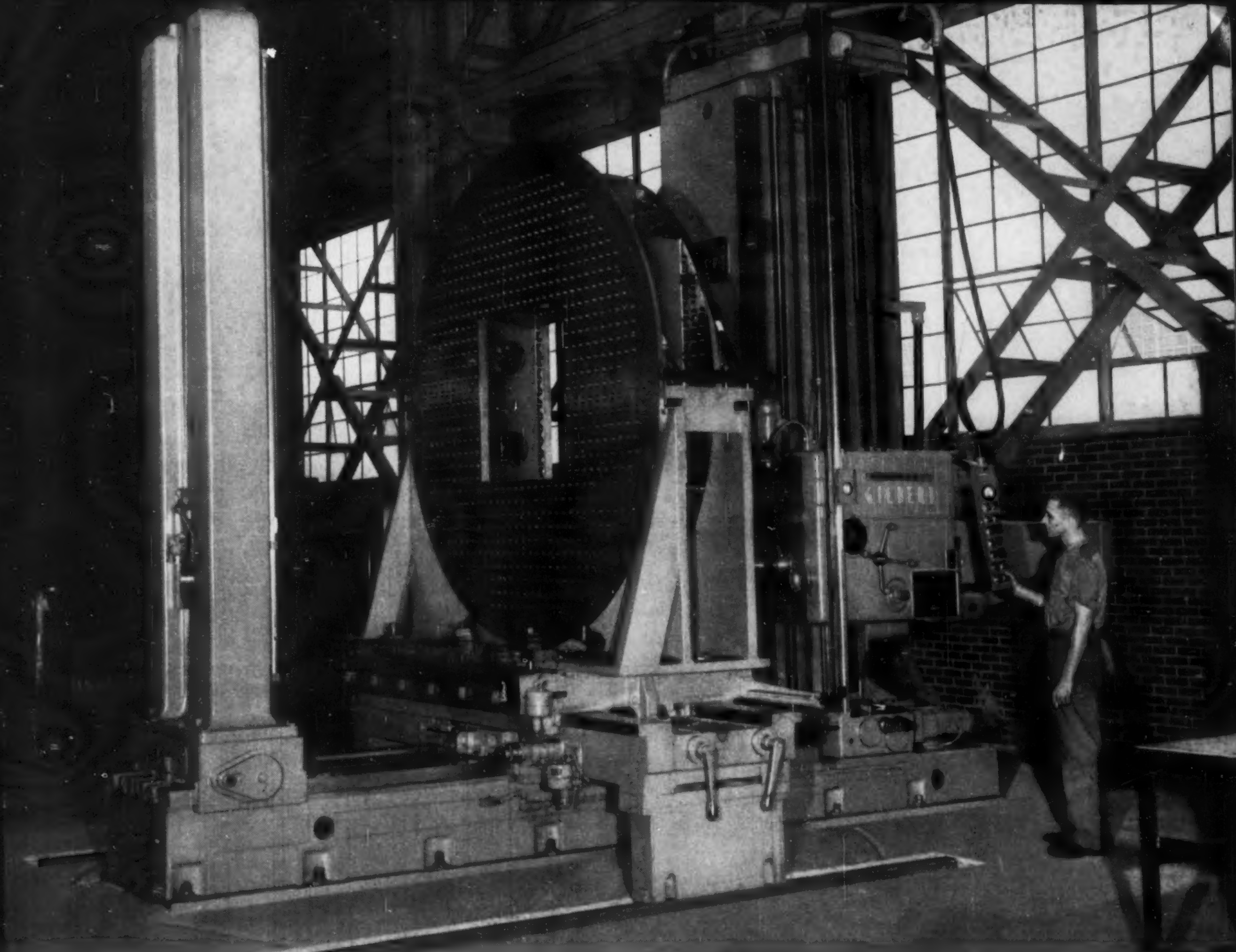
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Press Co., 511 Division St., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
L & J Press Corp., 1631 Sterling Ave., Elkhart, Ind.



Courtesy Combustion Engineering, Inc.

# Combustion Engineering uses Gilberts for precision boring on atomic reactors

It takes an unusual boring mill (specifically, a Cincinnati Gilbert) to meet the specifications on this job:

(a) diameters within .001″,

(b) parallelism of center line of holes to center line of plate within .0001″ per inch,

(c) parallelism of flat surfaces within .010″,

(d) 32 R.M.S. surface finishes.

These are some of the machining requirements on this part for a fast breeder reactor built in the Chattanooga plant of Combustion Engineering, Inc., pioneer manufacturer in the nuclear field. They are typical of the quality of work assigned to this Cincinnati Gilbert table type horizontal boring mill. Automatic positioning makes work-handling fast and precise.

A number of other Gilbert boring mills are producing similar close-tolerance work for Combustion Engineering—proof that "those who buy Gilbert buy Gilbert again."

New Bulletin 1157 will show you why Gilbert boring mills do so many things so well.

*The Cincinnati Gilbert Machine Tool Co., 3346 Beekman Street, Cincinnati 23, Ohio.*

*those who buy* **GILBERT** *buy Gilbert again*

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U. S. Tool Co., Inc., 255 N. 8th St., Ampere, East Orange, N. J.
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Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

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Hydraulic Press Mfg. Co., Mount Gilead, Ohio

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Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
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Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill.
Denison Engineering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
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Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

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Chambersburg Engineering Co., Chambersburg Pa.
Clearing Div., of U. S. Industries, Inc., 6499 W. 65th St., Chicago 38, Ill.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

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Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio
Erie Foundry Co., 1253 W. 12th St., Erie, Penna.
Farquhar, A. B. Div., 142 N. Duke St., York, Penna.
Federal Press Co., 511 Division St., Elkhart, Ind.
Hydraulic Press Mfg. Co., Mount Gilead, Ohio
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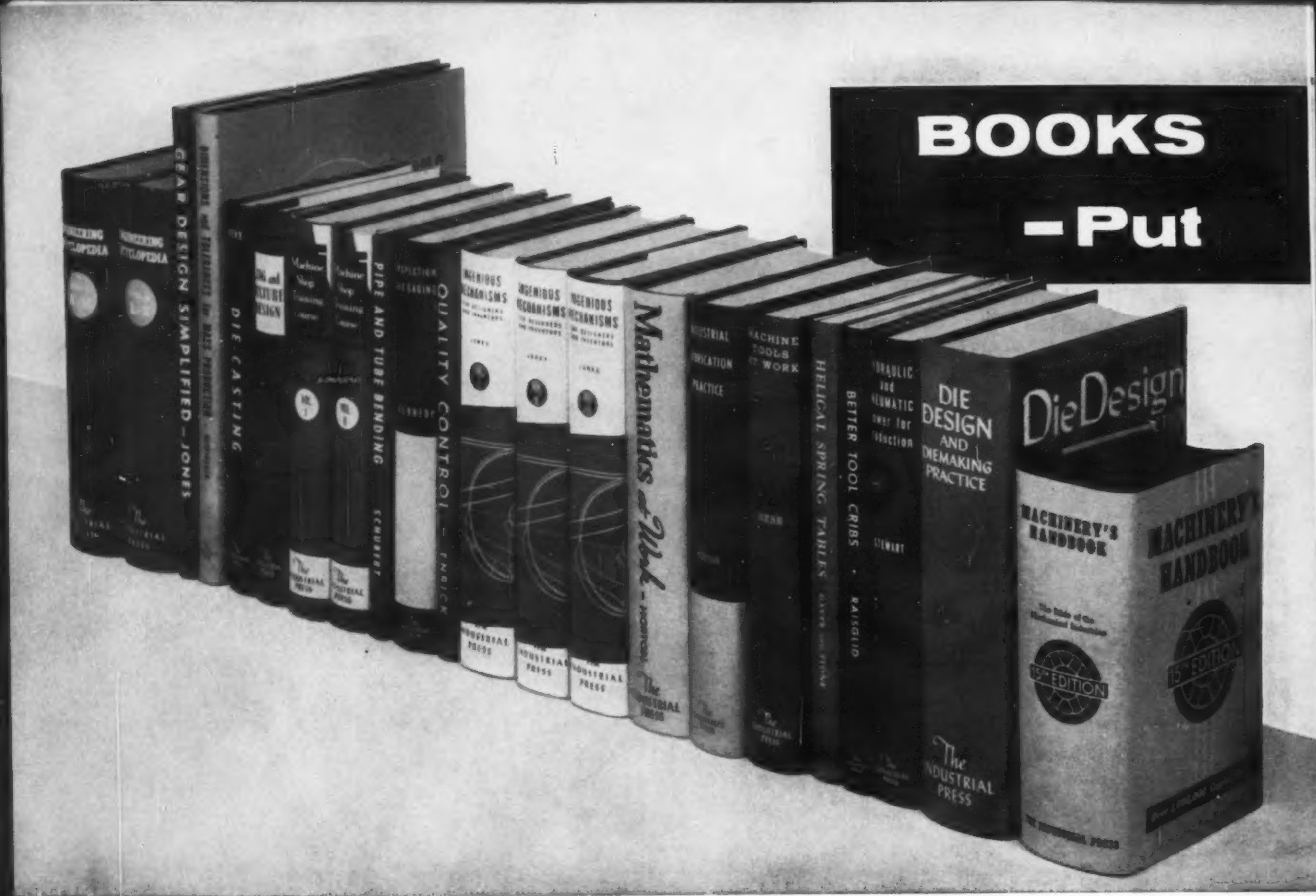


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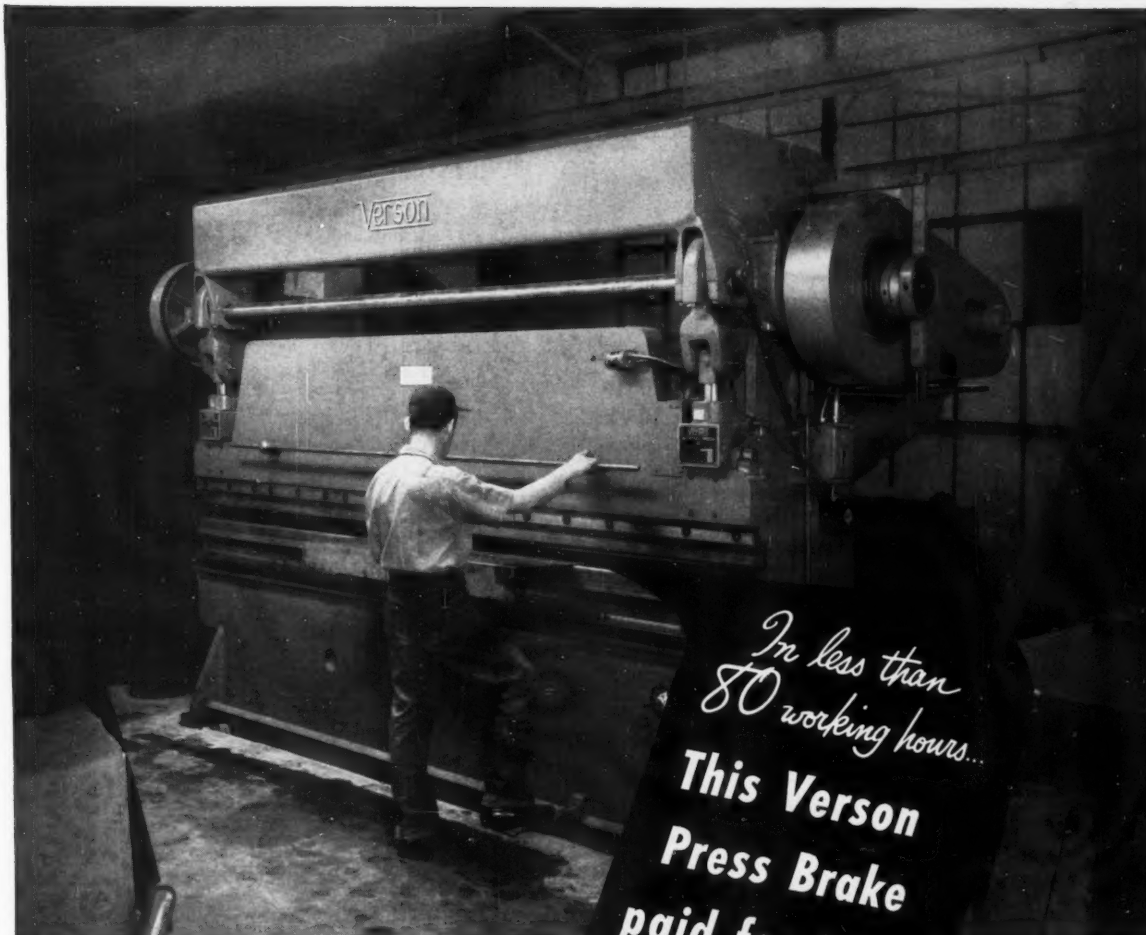


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Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Threadwell Tap & Die Co., Greenfield, Mass.

**STRAIGHTEDGES**—See Machinists' Small Tools

**STRAIGHTENERS, Flat Stock and Wire**

Bliss Co., E. W., Canton, Ohio.
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.
Verson Allsteel Press Co., 9309 S. Kenwood Ave., Chicago 19, Ill.
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

**STRIP AND SHEET, Ferrous**

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

**STRIP AND SHEET, Non-ferrous**

American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Co., Bethlehem, Pa.
Bridgeport Brass Co., Bridgeport, Conn.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

# MORE THAN MEETS THE EYE!

## FOR INSTANCE

Here are two examples typical of Williams cost-saving features.

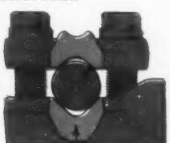
WILLIAMS CUTTING-OFF AND SIDE TOOL HOLDERS

Rugged cam-lock provides powerful clamp action on blade.

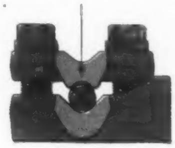
SIZE FOR SIZE SAME HOLDER TAKES BOTH STANDARD CUTTING-OFF BLADE AND SIDE TOOL BLADE. ONE HOLDER DOES THE WORK OF TWO. TOOL INVESTMENT IS CUT IN HALF.

WILLIAMS BORING TOOL HOLDERS

EACH HOLDER TAKES MANY SIZES OF BARS WITHOUT THE USE OF SLEEVES OR BUSHINGS WHICH CAN LEAD TO SPRING AND CHATTER.



V-BLOCK CONSTRUCTION PREVENTS CHATTERING SINCE BARS ARE GRIPPED AT FOUR POINTS AND CANNOT MOVE VERTICALLY OR HORIZONTALLY.



LOOK behind the performance of any Williams Tool Holder and you will find one or more superior features which make the big difference in rigidity and versatility . . . that save so many machine shop dollars.

**Buy Williams BETTER TOOLS FOR BETTER WORK from Catalog 303**

FOR PROMPT, PERSONAL SERVICE — INDUSTRIAL DISTRIBUTORS — THE RIGHT HAND OF PRODUCTION — CALL YOUR LOCAL DISTRIBUTOR

WILLIAMS DROP FORGED TOOLS OF INDUSTRY

**J. H. WILLIAMS & CO.**
DIVISION OF UNITED-GREENFIELD CORPORATION
409 VULCAN ST., BUFFALO 7, N.Y.

**STRUCTURAL SHAPES**

Bethlehem Steel Co., Bethlehem, Pa.
Revere Copper & Brass, Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 8, Ill.

**STUD SETTERS**—See Screwdrivers, etc.

**SUPERFINISHING EQUIPMENT**

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

**SURFACE PLATES**

Brown & Sharpe Mfg. Co., 235 Promenade St., Providence 1, R. I.
DoALL Co., Des Plaines, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.

**SWITCHES, Limit**

Allen-Bradley Co., 1331 So. 1st St., Milwaukee, Wis.

**TACHOMETERS**—See Indicators, Speed

**TAP HOLDERS**

Brown & Sharpe Mfg. Co., 235 Promendae St., Providence 1, R. I.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., S. 7th and N. Sts., Richmond, Ind.

**TAPPING HEADS**

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Davis Boring Tool Div., Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Jarvis Corp., Stack Ave., Middletown, Conn.
Kato Mfg. Co., Osaka, Japan
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Leland-Gifford Co., 1425 Southbridge St., Worcester, Mass.
National Automatic Tool Co., S. 7th & N. Sts., Richmond, Ind.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**TAPPING MACHINES**

Baker Brothers Inc., 1000 Post Ave., Toledo 10, Ohio.
Baush Machine Tool Co., 15 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport 5, Conn.
Buhr Machine Tool Co., 839 Greene St., Ann Arbor, Mich.
Burg Tool and Mfg. Co., Inc., 15001 S. Figueroa, Gardena, Calif.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.
Cincinnati Bickford Div. of Giddings & Lewis Mch. Tool Co., Oakley, Cincinnati 9, Ohio.
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.
Edlund Machinery Co., Cortland, N. Y.
Ettco Tool Co., Inc., 594 Johnson Ave., Brooklyn 37, N. Y.
Hamilton Tool Co., 834 S. 9th St., Hamilton, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.
Landis Mch. Co., Waynesboro, Pa.
Le Maire Machine Tool Co., 2657 S. Telegraph Rd., Dearborn, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

**TAPS, Hand, Machine Screw, Pipe, etc.**

DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Jarvis Corp., Stack Ave., Middletown, Conn.
Sheffield Corp., Box 893, Dayton 1, Ohio.
Threadwell Tap & Die Co., Greenfield, Mass.
Winter Bros. Co., Rochester, Mich.

**TAPS, Collapsing**

Greenfield Tap & Die Corp., Greenfield, Mass.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.


# ... performance beyond the usual ...

Design of high-speed precision machinery often calls for bearings which offer the utmost in load capacity, "hot hardness", dimensional stability. Each machine presents its own exacting requirements.

Fulfillment of unusual requirement combinations is a specialty at Rollway. Your selection of exactly the right precision radial cylindrical roller bearing is assured by:

- **A broad range of types and sizes, numbered in the thousands**
- **Retainers of standard bronze or "Rollube" ferrous alloy, in roller-riding, land-riding, or broached construction**
- **Crowned rollers**
- **Modification of any factor to meet your application**

**ROLLWAY**

# MAXIMUM

**BEARINGS**

To further implement your choice, the Rollway Catalog and Engineering Data Book contains the first listing, by any manufacturer, of the thrust capacities of cylindrical radial roller bearings.

**ROLLWAY BEARING CO., Inc., Syracuse 1, N. Y.**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**TESTING EQUIPMENT, Air, Oil & Water Pressure**
Lamb, F. Joseph Co., 5663 E. Nine Mile Rd., Detroit 34, Mich.

**THREAD CUTTING MACHINES**
Davis & Thompson Co., 4460 W. 124th St., Milwaukee 10, Wis.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio.

**THREAD CUTTING TOOLS**
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Geometric Tool Co. Div., Greenfield Tap & Die Corp., New Haven 15, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Sheffield Corp., Box 893, Dayton 1, Ohio.

**THREAD ROLLING DIES**—See Dies, Thread Rolling

**THREAD ROLLING EQUIPMENT**
Hartford Special Machinery Co., 287 Homestead Ave., Hartford, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland 3, Ohio.
National Machinery Co., Tiffin, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., Box 893, Dayton 1, Ohio.
V & O Press Co., Hudson, New York
Waterbury Farrel Foundry & Mach. Co., Waterbury, Conn.

**TOOL CONTROL BOARDS**
Cross Co., P. O. Box 3835, Park Grove Postal Sta., Detroit 5, Mich.

**TOOL HOLDERS**
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Burgmaster Corp., 15001 S. Figueroa, Gardena, Calif.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
DeVlieg Microbore Div., 2720 W. Fourteen Mile Road, Royal Oak, Mich.
Kennametal, Inc., Latrobe, Penna.
Metal Carbides Corp., 6001 Southern Blvd., Youngstown 12, Ohio.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.

**TOOL MATERIAL, Cast Non-Ferrous Alloy**
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Vascoloy-Ramet Corp., Waukegan, Ill.

**TOOL MATERIAL, Cemented Carbide**
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio.
DoALL Co., 254 N. Laurel Ave., Des Plaines, Ill.
Kennametal, Inc., Latrobe, Penna.
Metal Carbides Corp., Youngstown 12, Ohio.
Vascoloy-Ramet Corp., Waukegan, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

**TOOL MATERIAL, Ceramic**
Metal Carbides Corp., Youngstown 12, Ohio.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Vascoloy-Ramet Corp., Waukegan, Ill.

**TOOL MATERIAL, High-Speed Steel**
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Carpenter Steel Co., 105 W. Bern St., Reading Penna.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland 14, Ohio
Vanadium-Alloys Steel Co., Latrobe, Penna.

**TRACING ATTACHMENTS**
American Tool Works Co., Pearl & Eggleston Aves., Cincinnati 2, Ohio.
G & L and Hypro Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorton Mch. Co., 1321 Racine St., Racine, Wis
Jones & Lamson Mch. Co., 512 Clinton St., Springfield, Vt.
Wales-Strippit, Inc., Akron, N. Y.
Warner & Swasey, 5701 Carnegie Ave., Cleveland 3, Ohio.

**TRANSFER MACHINES**
See Multiple-Station Machines

**TRANSMISSION, Variable Speed**
Barnes, John S. Corp., Rockford, Ill.
Boston Gear Wks., Quincy, Mass.
Denison Engineering, Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus, Ohio.
Oilgear Co., 1569 W. Pierce St., Milwaukee Wis.
Vickers, Inc., Detroit 32, Mich.

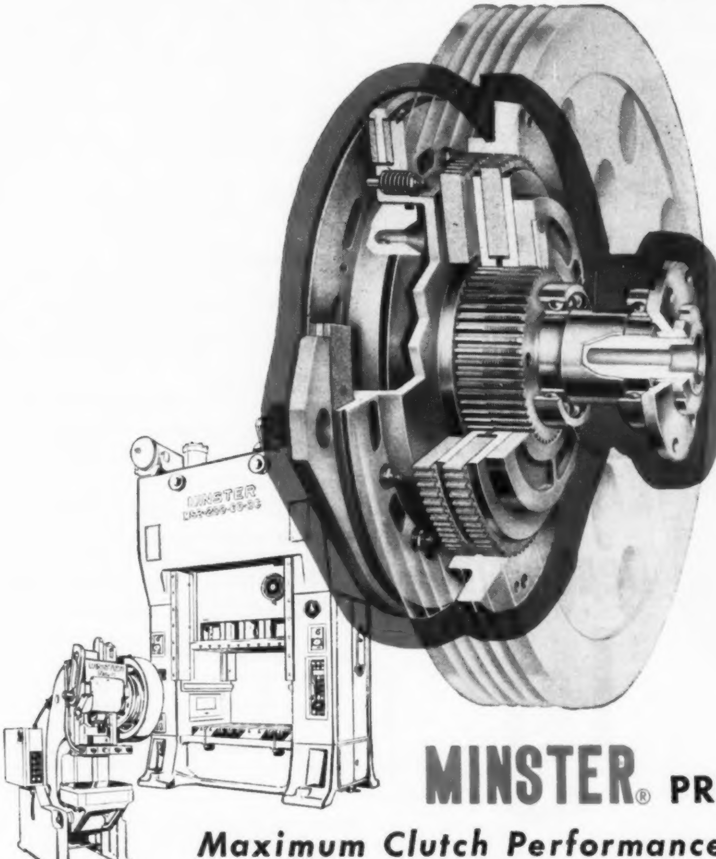
**TRUCKS, Material Handling**
Hamilton Tool Co., 834 So. 9th St., Hamilton Ohio.

**TUBE-FLANGING MACHINES**
Niagara Mch. & Tool Wks., 637-697 Northland Ave., Buffalo 11, N. Y.

**TUBE FORMING AND WELDING MACHINES**
Yoder Co., 5504 Walworth Ave., Cleveland, Ohio.

**TUBE MILLS**
Yoder Co., 5504 Walworth Ave., Cleveland, Ohio.

# There's a BIG DIFFERENCE in AIR FRICTION CLUTCHES



## THE MINSTER CLUTCH IS MORE EFFICIENT

## MINSTER® PRESS USERS *Always Get*
## *Maximum Clutch Performance and Longest Clutch Life*

It's not unusual for the clutch and brake on a Minster press **to perform, shift after shift, on rapid single cycle operation for eight, ten or twelve years without ever being disassembled for relining.**

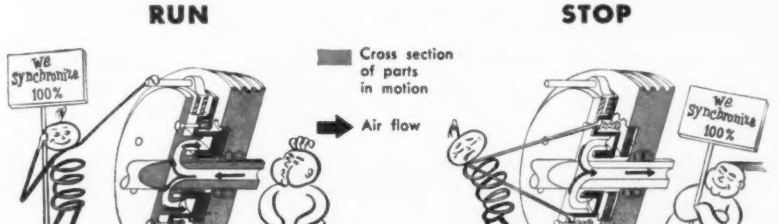
Users of all types and sizes of Minster presses consistently get that kind of service from the Minster patented Combination Air Friction Clutch and Brake.

Improvements in the design of the Minster clutch are being made continuously by Minster, **the press builder that developed and pioneered the air friction clutch for presses.** Performance records prove that, with a Minster clutch, the length of service and operational value is there.

Next time you're evaluating press equipment or considering a press clutch conversion, bear in mind, all air friction clutches are not alike.

## THE MINSTER MACHINE COMPANY, MINSTER, OHIO

**RUN** **STOP**




AIR IN—CLUTCH ENGAGED—(brake off) AIR OUT—BRAKE APPLIED—(clutch disengaged)

**Compare the number of parts . . .**

*The Minster Combination Air Friction Clutch and Brake is one synchronized unit with one moving member engaging the clutch by air pressure in one direction and applying the brake in the opposite direction as air exhausts. Movement from full brake to complete engagement is the absolute minimum, assuring fast action at any speed for quick, controlled stopping.*



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### TUBING, Non-ferrous
American Brass Co., 25 Broadway, New York, N. Y.
Metal Forming Corp., Elkhart, Ind.
Mueller Brass Co., Port Huron 34, Mich.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.

### TUBING, Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
Metal Forming Corp., Elkhart, Ind.
National Tube Div., U. S. Steel Corp, 525 Wm. Penn Place, Pittsburgh, Pa.
Revere Copper & Brass Inc., 230 Park Ave., New York 17, N. Y.
Ryerson, Jos. T., & Son, Inc., 16th & Rockwell Sts., Chicago 18, Ill.
Timkin Roller Bearing Co., Canton, Ohio.

### TUBE & PIPE CUTTING-OFF MACHINES
Grieder Industries, Inc., Bowling Green, Ohio.
Sheffield Corp., Box 893, Dayton 1, Ohio.

### ULTRASONIC MCH. TOOLS
Sheffield Corp., Box 893, Dayton 1, Ohio.

### VALVE CONTROLS
Barnes, John S. Corp., Rockford, Ill.
Logansport Mch. Co., Inc., Logansport, Ind.
Vickers, Inc., Detroit 32, Mich.

### VALVES, Air
Hydraulic Press Mfg. Div., Mt. Gilead, Ohio
Logansport Mch. Co., Inc., Logansport, Ind.
Mechanical Air Controls, Inc., Oak Park, Mich.
Numatics, Inc., Milford, Mich.
Ross Operating Valve Co., 110 E. Golden Gate Ave., Detroit 3, Mich.
Schrader's Son, A., 470 Vanderbilt Ave., Brooklyn 38, N. Y.
Skinner Electric Valve Div., New Britain, Conn.
Tomkins-Johnson Co., 617 N. Mechanic St., Jackson, Mich.

### VALVES, Hydraulic
Barnes, John S. Corp., Rockford, Ill.
Denison Engineering Div. American Brake Shoe Co., 1152 Dublin Rd., Columbus 16, Ohio.
Elmes Eng. Div., American Steel Foundries, 1150 Tennessee Ave., Cincinnati 29, Ohio.
Hydraulic Press Mfg. Div., Mount Gilead, Ohio.
Logansport Machine, Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1569 W. Pierce St., Milwaukee, Wis.
Vickers Incorporated, Division of Sperry Rand Corp., 1402 Oakman Blvd., Detroit, Mich.

### VERNIERS—See Calipers, Vernier; Gages, Vernier

### VISES, Machine
Bridgeport Mches., Inc., 500 Lindley St., Bridgeport 6, Conn.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling & Grinding Mches., Inc., 4701 Marburg Ave., Cincinnati 9, Ohio.
Cincinnati Milling Mch. Co., Oakley, Cincinnati 9, Ohio.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Modern Mch. Tool Co., 2005 Losey Ave., Jackson, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Detroit 20, Mich.

### WELDING EQUIPMENT, Arc
Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.
Linde Co., 30 E. 42nd St., New York 17, N. Y.

### WELDING EQUIPMENT, Gas
Air Reduction Sales Co., 150 E. 42nd St., New York 17, N. Y.
Linde Co., 30 E. 42nd St., New York 17, N. Y.

### WELDING EQUIPMENT, Resistance
Eisler Engrg. Co. Inc., 750 South 13th St., Newark, N. J.

### WELDING POSITIONERS
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.

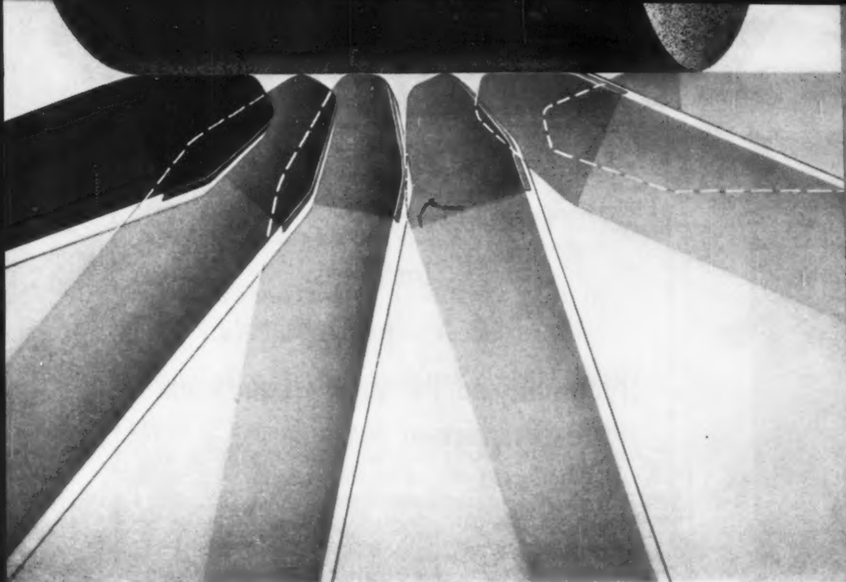
### WELDMENTS
Bliss, E. W. Co., Canton, Ohio.
Verson Allsteel Press Co., 93rd St. & S. Kenwood Ave., Chicago, Ill.

### WIRE
Allegheny Ludlum Steel Corp., Pittsburgh, Pa. (Stainless)
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., 105 W. Bern St., Reading, Penna.
U. S. Steel Corp., 525 Wm. Penn Pl., Pittsburgh 30, Penna.
Vanadium-Alloys Steel Co., Latrobe, Penna.

### WIRE FORMING MACHINES
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Eisler Engrg. Co., Inc., 750 South 13th St., Newark, N. J.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, E. Orange, N. J.

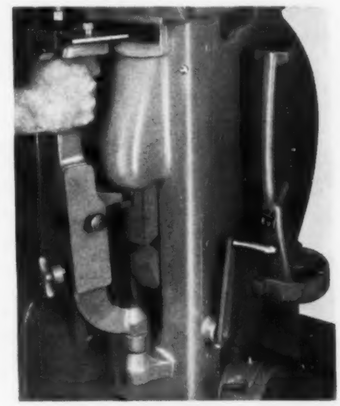
### WOODWORKING MACHINES
Greaves Mch. Tool Div., 2011 Eastern Ave., Cincinnati 2, Ohio.
Greenlee Bros. & Co., 2136—12th St., Rockford, Ill.

### WRENCHES, Allen, End, Socket, Adjustable, etc.
Allen Mfg. Co., Bloomfield, Conn.
Armstrong Bros. Tool Co., 5213 W. Armstrong Ave., Chicago 46, Ill.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York 17, N. Y.
Williams, J. H. & Co., 400 Vulcan St., Buffalo 7, N. Y.



## How to add dividends to single point tools

The tool room can add four "dividend areas" through use of the Oliver 20" Template Tool Bit Grinder and can protect initial investment in tool bits. The dividends available to you are (a) rapid sharpening, (b) positive duplication, (c) grinding wheel economy and, (d) high salvage value.



The total time involved in sharpening a tungsten carbide tipped tool bit is negligible. An average ¾" square tool calling for a total stock removal of about 1/32" is sharpened completely in approximately 30 seconds. This includes all angles, radii and soft steel support.

Positive duplication is readily assured. Once your tool engineer has determined the proper shape and clearance for best results, it is important that there be no guess work on subsequent grinds. The Oliver template control insures such a grind.

Grinding wheel economy is extraordinary. Practically all users have found secondary diamond wheel finishing of carbide tipped tools completely unnecessary. The 20" diameter silicon carbide wheel produces a micro-finish almost equal to that ground with a diamond wheel.

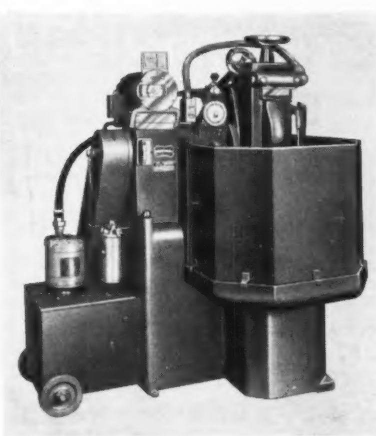
Your tool bits *can* have a high salvage value. It is common practice to discard tool bits when the carbide contains an area which has broken out for a considerable distance. The removal of the damaged area is quite expensive by ordinary grinding methods. The Oliver Tool Bit Grinder permits the removal of ⅛" or ¼" of carbide in a minute or two, thus giving you new tool performance once again at a very low cost.

# OLIVER Template Tool Bit Grinder

## Duplicates Precisely in One Operation

That's right! The Oliver Template Tool Bit Grinder sharpens single point tungsten carbide, high speed and stellite turning tools . . . duplicating exactly all original flats and radii every time the tool is ground . . . in one simple, efficient grinding operation.

How is it done? Well, as you can see from the drawing above the answer lies in "template control." The template at the top of the specially designed tool holder is a twice size replica of the tool form being ground. The tool, securely held at mid-point in the holder, contacts the wheel and is ground until the template touches the template stop. In this manner, the tool is ground to the *exact* profile of the template. The entire operation is performed in seconds—easily, accurately on one machine . . . a machine that pays for itself by reducing your tool inventory and by eliminating lost production time and tool breakage.



Want proof? Oliver will grind your tools on a "no charge" basis. Write today for full information. We'd like the opportunity of sending you a quotation.

# OLIVER of ADRIAN

1410 E. Maumee St. • Adrian, Michigan

DRILL GRINDERS AND THINNERS—TOOL AND CUTTER GRINDERS—AUTOMATIC AND MANUAL FACE MILL GRINDERS—TOOL BIT GRINDERS—CONTOUR SAWING AND FILING MACHINES

# USE THIS NEW KIND OF DIAMOND CUT-OFF WHEEL

Gives narrower, smoother cuts on industry's toughest materials

**. . . yet prices start at only $32.25**

Now . . . at *production prices* . . . DIATRONIC gives you a rim width of .006″ that's accurate to a maximum total tolerance of .0005″—or your money back. This accuracy is built in by a new process. No break-in needed. New narrow cut reduces sawdust loss 30%. A must for $3,000-a-pound silicon or germanium crystal. Cuts tungsten carbide, corundum, aluminum oxide, glass . . . practically anything. Stock orders shipped in hours; special wheels available. Write for literature, price list.

*Another invention marketed by*

**NAVAN PRODUCTS, INC.**

Subsidiary of North American Aviation, Inc.

**Dept. 141, International Airport, Los Angeles 45, Cal.**

**DIATRONIC* DIAMOND WHEELS**

"with built-in tolerance"

*TRADEMARK

For more data cicle Item 703 on Inquiry Card

# BRITISH PRECISION GEARS

ALL TYPES & GEARED ASSEMBLIES FOR-
ELECTRONIC
MISSILE
INSTRUMENT
AIRCRAFT
BUSINESS
MACHINERY
ETC....

ENCLOSE DRAWINGS FOR KEEN QUOTATIONS BY RETURN

*WRITE DIRECT TO:-*

**THE DAVALL GEAR COMPANY LTD**

POTTERS BAR · MIDDLESEX · ENGLAND

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# NOW

# Standard SUBLAND DRILLS IN LOCAL STOCKS

SHORT

MEDIUM

LONG

**FOR DRILLING and CHAMFERING PRIOR TO TAPPING—**

***IMMEDIATELY AVAILABLE***

**ALL PRACTICAL SIZES IN 3 STEP LENGTHS 3 SHANK STYLES**

with Straight Shank, Tapered Shank or Jobbers Length

Now...Mohawk Subland Drills are manufactured in *all* practical *standard* sizes, in 3 step lengths and 3 shank styles—to meet all drilling-chamfering requirements. And, Mohawk Standard Sublands sizes match accepted industry practice on unified thread sizes, hole tolerances, etc.

Why? Because Mohawk Standard Sublands affords a faster, more accurate economical method of simultaneously drilling and chamfering clean, concentric holes for better tapping operations—plus a saving in tap costs.

Mohawk Standard Subland Drills are available direct from your local distributor's stock—immediately! Start saving production time and equipment dollars today. Call the Mohawk man right now!


**Just off the press! This new 12-page Catalog illustrates the multiple advantages of Mohawk Standard Subland Drills. Yours for the Asking!**

*world's largest producer of Sublands*

Mohawk TOOLS, Inc.

MONTPELIER, OHIO

For more data circle Item 705 on Inquiry Card

# A Grieder Tube Cut-Off Machine will produce 4500 to 6500 cut-offs per hour


Grieder Tube Cut-Off Machines are 3 to 8 times faster than others, and speed is only one of the cost saving advantages they provide. For example:

- $ Cut tubing of any shape to any length—steel, copper, brass, aluminum and alloys. Continuous automatic operation.
- $ Lengths can be held to plus or minus .002" on light wall tubing and to .003" on heavier.
- $ Precision clamping dies prevent tube distortion and produce a quality cut. Tube does not rotate.
- $ Thousands of cuts without grinding. Blades can be sharpened on standard tool room equipment and used for as many as a million cuts.

Write for literature, stating tube sizes and production requirements.

**Grieder**
TUBE CUT-OFF MACHINES

GRIEDER INDUSTRIES, INC.
P. O. Box 169 • Bowling Green, Ohio

Please send bulletin describing Grieder Tube Cut-Off Machines.

NAME____________
COMPANY____________
CITY____________ ZONE______
STATE____________

For more data circle Item 706 on Inquiry Card

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## low cost HYDRAULIC KEYSEATER

**cuts standard, tapered keyways ¼" to 2" wide**

- fast set-up—saves time and money
- low cost operation-uses standard tool bits
- heavy-duty hydraulic circuit—assures accurate keyways
- compact, 21" x 61"—no special foundation

*Send for Bulletin 34*

**E. W. BLISS COMPANY**
1132 N. Seventh St., San Jose, Calif.

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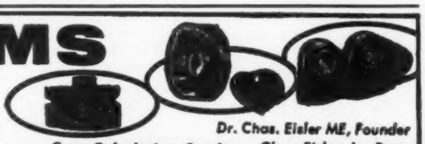
# CAMS



**ALL TYPES MADE TO YOUR SPECS!**

Cam Calculating Service

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**EISLER** ENGINEERING CO., INC.

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## JIG AND FIXTURE DESIGN

**A practical book with 382 pages of information on the design and construction of jigs and fixtures for drilling, boring, planing and milling. $5 per copy. Sent on approval.**

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*Adjustable*

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*The only heads of this type standard with*

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# Classified and Re-Sale Section

**CLASSIFIED ADVERTISING RATES: $12 per single column inch**

## eastern Rebuilt Machine Tools

### THE SIGN OF QUALITY

### THE MARK OF DEPENDABILITY

The listing below is only a VERY SMALL AMOUNT of the total number of machine tools that we have in stock for immediate shipment. Our prices are realistic with today's market and our quality of rebuilding is the same high standard— THE LEADER IN THE FIELD OF REBUILT MACHINE TOOLS.

**UNIVERSAL GRINDERS**
14x36" Norton, m.d.
14"x48" Landis Type C, m.d.
14x72" Norton Universal Hydraulic, m.d.

**SNAG GRINDERS**
7½ H.P. United States Elec. Tool. Co. Double End, Model 80, new
Type No. 50—7½ H.P. Standard Elec. Tool Co. Double End, m.d.
25 H.P. U.S. Elec. Co., Heavy Duty Double End, m.d.

**THREAD GRINDERS**
No. 33 Excello Precision, m.d.

**UPRIGHT DRILLS**
Model H4 Barnes Hydram
Model H3 Barnes Hydram, m.d.
20" Barnes, m.d., 1940
20" Barnes All Geared Self-Oiling Drill & Tapper, m.d.
20" Cincinnati-Bickford Super-Service Prod. Drill, m.d.
21" Cincinnati-Bickford, single spindle, m.d.
No. 2AL Natco Holesteel Vertical, m.d.
No. 2 Colburn Mfg. Type, m.d.
No. 201-¼" Barnes Single Sp. Upright Self-Oiling All Geared Drill & Tapper, m.d.
No. 25 Foote-Burt. m.d., H.D.
No. 150 Baker H.D. Single Spindle, vee belt m.d.
No. 242 Barnes Single Spindle, vee belt m.d.

**GEAR GRINDING MACHINES**
6x20" Fitchburg Hydraulic Spline & Gear, m.d.
GG19 Gear Grinding, m.d., latest
GG31 Gear Grinding, internal geared & spline grinder, m.d.
15" National Broach Red Ring Gear Lapper, m.d.
18" National Broach Red Ring Gear Lapper, m.d., late

**GEAR SHAPERS**
Type Z Fellows Horizontal, m.d.
No. 4 Fellows Enveloping Gear Generator, m.d.
No. 12 Fellows Gear Shaving Machine, m.d., late
No. 7 Fellows, 1945
No. 7, 7A Fellows Gear Shapers, melted m.d.
No. 18 Fellows Gear Finishing Machine, m.d.
No. 61A Fellows, m.d., latest type, 1945
No. 615A Fellows Spur & Helical, belt drive
No. 645A Fellows, m.d.
No. 645A3 Fellows, vee belt drive
No. 645Y Fellows, m.d.
No. 70 Cross Deburring Machine, m.d., 1940
No. 72 Fellows H.S. Spur Gear Shaper, m.d.
No. 725 Fellows, 1945
No. 75 Fellows, H.S., m.d.
No. 75A Fellows, H.S. Spur & Helical, m.d.
No. 712 Fellows, m.d.
No. 7125A Fellows, H.S., m.d.

**GEAR CUTTERS**
No. 12 Gleason Straight Tooth Bevel Gear Rougher, m.d.
No. 36 Gould & Eberhardt Bevel & Spur Gear Rougher, m.d.
No. 4B Fellows Gear Burnisher
No. 8B Fellows Gear Burnisher
3" Gleason Gear Generator, m.d.
48" Gleason Automatic Bevel Gear Planer, m.d.
No. 5AC Lees-Bradner Heavy Type Gear Generator, m.d.
No. 4-48" Brown & Sharpe, m.d.
No. 50 Cross Clutch Miller, m.d.

**GEAR HOBBING MACHINES**
Type A Barber-Colman, m.d.
Type 8 Barber-Colman, m.d.
Type T Barber-Colman, 1942
No. 1 Lees-Bradner Universal, m.d.
No. 12 Barber-Colman, Double Overarm, m.d.
No. 12 Barber-Colman, single overarm, m.d.
No. 34 Brown & Sharpe, m.d. spur & spiral
No. 130 Cleveland Vertical Rigid Hobber
No. 12H Gould & Eberhardt Universal Mfg. Gear Hobber, m.d.

**GEAR TESTERS**
Type 8M Fellows Red Liner, m.d.
FPV-60 Maag Gear Wheel Co. Profile Testing Instrument
12" National Broach & Machine Co.
18" National Broach & Machine Co.
18" Gleason Bevel Gear Tester, m.d.
No. 471 Michigan Tool Co. Hob, Reamer & Gear Checker
National Broach & Machine Co. "Red Ring" Universal Gear Checker

**AUTOMOTIVE GRINDERS**
No. 76 Van Norman Automatic Piston Turning & Grinding Machine, m.d.
Kwik-Way Model H Piston Turning & Grinding Machine, m.d.

**CENTERLESS GRINDERS**
No. 2 Cincinnati, Filmatic Spindle
No. 2 Cincinnati, M.d.
No. 3 Cincinnati, m.d.

**CRANKSHAFT GRINDERS**
18x66" Landis Universal Type C, m.d., late
22x72" Landis Type CH, m.d., late

**CYLINDER GRINDERS**
No. 50 Heald, m.d., 1945
No. 73 Heald Airplane Cylinder Grinder, m.d., new
No. 78 Heald Centerless Cylinder, m.d.

**EMERY GRINDERS**
48" Double End U.S. Electric Co. Buffer
No. 5D Gardner H.D. Polishing Stand

**DISC GRINDERS**
No. 14A Gardner Opposed Spindle, m.d.
No. 186-36" cap. Gardner, m.d., latest
No. 121 Hanchett Prod. Face Grinder, m.d.
Model 372-53" Besly Single Spindle Vertical, m.d.

**SURFACE GRINDERS**
No. 16 Blanchard Rotary, m.d.
No. 16A-2 Blanchard Auto. Rotary, m.d.
No. 33 Abrasive, m.d.
14" Pratt & Whitney Vertical, m.d.
14" Pratt & Whitney Model M 1640 Vertical, m.d.
No. A-1-8" Arter Surface Grinder
No. 22-12" Heald Rotary, m.d.
No. 25-A-24" Heald Rotary, m.d.
No. 2 Brown & Sharpe, m.d.
#300-60 Hanchett Vertical Spindle, m.d.
Model 84A-61" Bridgeport Hydraulic Face, m.d.
Schonherr Way Grinder, radial arm

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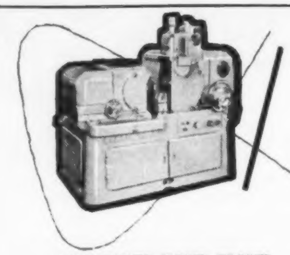

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BALANCER. Model 2E0 Tinius Olsen, 1948
BORER, No. 1212 Excell dbl. end
BORING MILL. 3¾" bar No. 5 DeRanee, 1942
BORING MILL. 4" Universal Tri-Way 1000 RPM
BORING MILL. 60" Gisholt vert. PRT
CENTERING MACHINES. Nos. 53 & 56 Sundstrand up to 72" between centers
CHUCKER, 675 New Britain late
DRILL, No. 262 Barnes all-geared upright 1943
DRILL No. 20 HO Baker hydr. late
GRINDERS, C'LESS. No. 12 Landis, 1947
GRINDER, CYL. 4" x 12" No. H. Landis, 1943
GRINDERS. UNIV. 14" x 14" Mod. 112 Rivett
GRINDERS, CYL. 20" x 72" Landis, 1943
GRINDER. INT. No. 271 Heald size matic 1951
GRINDER, INT. 72A5 Heald, Univ., Hydr.
GRINDER, INT. No. 74 Heald Hydr., 1941
GRINDER, SURF. 8" x 24" x 36" DoAll hydr. 1948
GRINDER, 12" x 16" Mattison, 1942
GRINDER, SURF. 20" x 24" No. 25A Heald
GRINDER, SURFACE. 12" x 16" x 36" Mattison. Mag. chuck and rest., 1942
GRINDER, CUTTER. 30" Ingersoll, 1942
GRINDER, CARBIDE, Nos. 48 and 49 Excello
GRINDER, RADIUS, No. 49 VanNorman, late
GRINDER, TOOL & CUTTER. No. 2 Cincinnati
HOB SHARPENER. Type HRS Barber Colman
KELLER. BL2416 Pratt & Whitney 3 Spdl 1941
LATHE, 16" x 54" AMERICAN "PACEMAKER" 1941
LATHES, ENGINE. 13", 15" & 17" LeBlond
MILLER, AUTO 2-20 Kent Owens, 1942
MILLER, AUTO 36" No. 33 Sundstrand
MILLER, DUPLEX, 4-48 CINCINNATI 1945
MILLER HAND. No. 2RV Kent-Owens, 1942
MILLERS. No. 10 & 3 VanNorman Duplex
MILLER, PLAIN. No. 2 Cincinnati HSDT, 1940
MILLER PLAIN. No. 3H K & T MSDT 1943
MILLER VERT. No. 2 Brown & Sharpe HSDT, 1943
MILLER. No. 36 VanNorman, ram type, 1942
MILLING MACHINES, HORIZONTAL, No. 5H Kearney & Trecker, plain with Vert. Hd., 1941
SAW. 10" x 10" Racine Hydr., Hack, 1941
SHAPER. 6" P&W vert., also 12"
SHAPER, 16" Rockford hydr. univ. 1943
SLOTTER, 36" Rockford Hydraulic, 1942, excellent
TAPPER No. 10 Warner & Swasey. 1948
THREADER. 1½" HILL ACME LEAD SCREW 1942

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### Stops Losses
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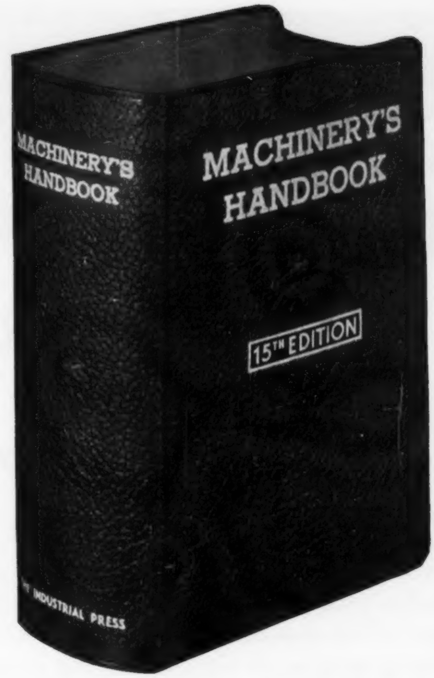


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# LELAND-GIFFORD NO. 3 MVB TOOLROOM DRILL PRESS

A companion machine to the widely used Leland-Gifford No. 2 LMS Toolroom Drill Press — providing extra capacity with comparable features and conveniences. This machine is always available to help with heavy-duty production work while handling the general run of toolroom drilling and tapping with effortless speed and ease.

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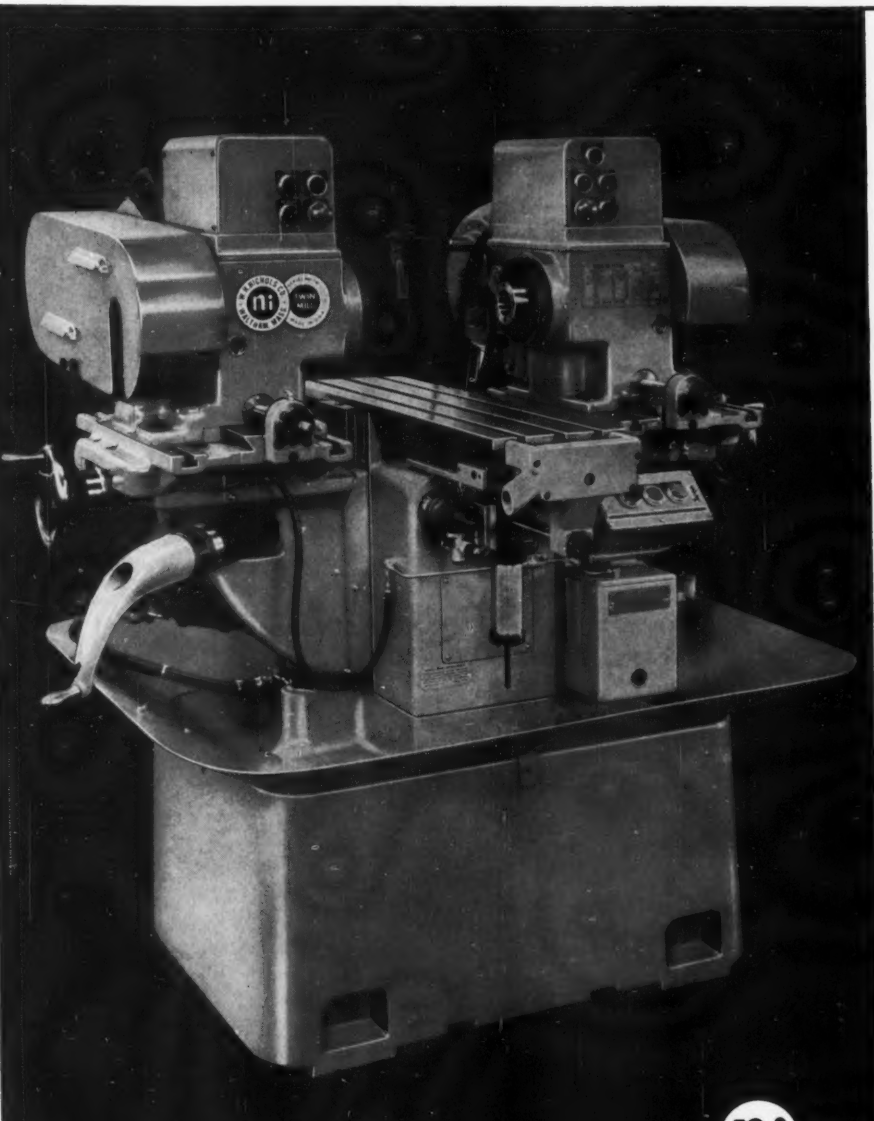


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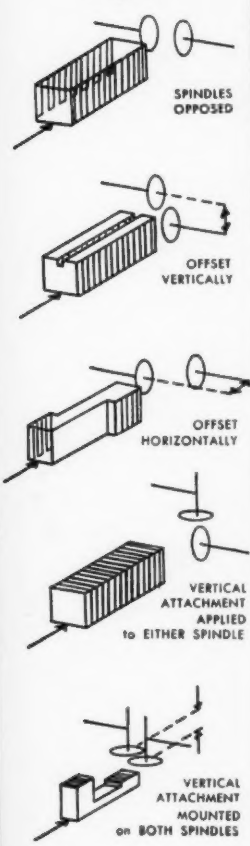


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# 3 new applications get longer life and minimum maintenance using Dodge pillow blocks with Timken® bearings

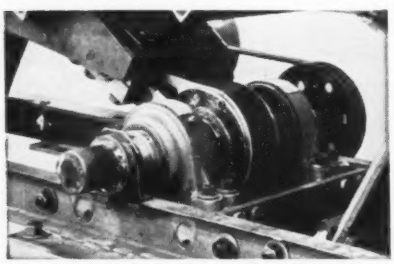
PICTURED below are three applications where Timken bearing equipped Dodge pillow blocks stay on the job with little attention under tough conditions. Their tapered design lets Timken® bearings take *both* radial and thrust loads in any combination. And full-line contact between rollers and races provides extra load-carrying capacity. Wear is reduced, maintenance is cut to the minimum.

Cutaway view shows the Dodge All-Steel pillow block with Timken bearing mounting. Of special design, the bearing has a tapered bore with self-aligning spherical outer surface—never needs adjustment.

Besides the All-Steel pillow block, other versatile Dodge pillow blocks with Timken tapered roller bearings are: Type "E", Double-Interlock, Type "C" and Special Duty. All are compact in design. Special thrust devices that take up extra space are not needed.

And to get the finest steel for Timken bearings, we make it ourselves—America's only bearing manufacturer that does. So specify bearings trade-marked "TIMKEN" for the machines you buy or build. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

*This symbol on a product means its bearings are the best.*



Timken bearing-equipped Dodge All-Steel pillow block used in a vibrating conveyor.

Timken bearing-equipped Dodge Type "E" pillow block used in sand and gravel plant.

Timken bearing-equipped Dodge "Special Duty" pillow block as used on fine paper machine lineshafts.

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